CHAPTER

6

Industrial Conservation Program

6.1 INTRODUCTION

This chapter contains the Third Management Plan Industrial Conservation Program for industrial water users within the Pinal Active Management Area (AMA). The purpose of the industrial conservation program is to move industrial users to the greatest level of efficiency economically attainable given use of the latest available water conservation technology. In addition to conservation, the replacement of groundwater sources with renewable water supplies during the third management period will ensure that industrial users make effective strides toward contributing to the AMA's management goal.

The Groundwater Code (Code) defines industrial use of water as "a non-irrigation use of water not supplied by a city, town or private water company, including animal industry use and expanded animal industry use." A.R.S. § 45-561(5). An industrial user is a person who uses groundwater for an industrial use. In most cases, industrial users withdraw groundwater from their own wells, which are associated with a Type 1 or Type 2 non-irrigation grandfathered right or a groundwater withdrawal permit. These rights and permits have annual volumetric groundwater allotments. The total volume of Type 2 grandfathered rights in the AMA was set at the time the Code was adopted. The total volume of water associated with Type 1 grandfathered rights can increase over time as agricultural land with irrigation grandfathered rights is retired from production and the rights are converted to Type 1 grandfathered rights. General Industrial Use (GIU) permits are issued by the Arizona Department of Water Resources (Department) if water service cannot be secured from a municipal provider and if the use of surface water, effluent, or the purchase or lease of a grandfathered right is not economically feasible. GIU permits expire after a specified period of years. (See the Glossary of Terms for a description of water rights and permits.)

An industrial user may also receive groundwater from an irrigation district. However, an industrial user may not receive groundwater from an irrigation district in excess of the amount the industrial user was entitled to receive on June 12, 1980 unless it has obtained a Type 1 or Type 2 grandfathered right or a GIU permit. A.R.S. § 45-497(B).

There are also two types of groundwater users that, although served by municipal water providers, are subject to industrial program conservation requirements. These users include turf-related facilities and cooling towers and are defined as "individual users" in the management plan and are regulated through the municipal conservation program.

Conservation methods are important to the Pinal AMA in helping to achieve the management goal. Industrial facilities generally use water efficiently due to pumping costs and industrial discharge requirements that require that they recycle and contain water on site. The allotment-based conservation requirements for the turf industry have required turf-related facilities to comply with declining application rates since the First Management Plan or the AMA became effective in December 1985.

Groundwater constitutes the majority of industrial water use. However, some industrial users also use surface water, reclaimed water, or industrial wastewater. Regulatory incentives exist to encourage the use of renewable water supplies. Because industrial right holders have the legal authority to withdraw groundwater up to the annual allotment of their rights or permits and because the cost of pumping groundwater is relatively low compared to the cost of other sources of water, the Department has tried to develop meaningful incentives to encourage the use of renewable water supplies.

The use of renewable supplies by the industrial sector is constrained by proximity to the source, reliability, cost, and water quality issues. While turf-related facilities in the Pinal AMA use a moderate proportion of renewable supplies, use of these sources by other types of industrial users may require that the water be additionally treated to remove salts or other constituents.

Currently, the only industrial users utilizing renewable supplies exclusively are turf-related facilities. Turf-related facilities in the Pinal AMA utilized more than 2,100 acre-feet of effluent, Central Arizona Project (CAP) water, and surface water in 1995. This use accounted for more than 27 percent of the 1995 industrial user demand in the AMA. Industrial users are generally groundwater-dependent and use less renewable supplies than either the agricultural or municipal sectors. However, users in several industrial categories have expressed an interest in using renewable water supplies if they were available and comparable in cost to groundwater.

In all AMAs, significant amounts of industrial right and permit allocations are unused. These unused allocations represent a potential increase in allowable groundwater pumping.

For the third management period, there are general conservation requirements that apply to water use characteristics common to "all industrial users." In addition to these requirements, there are specific conservation requirements that apply to the following industrial users:

- Turf-Related Facilities ($\geq$ 10 acres)
- Large-Scale Cooling Facilities (> 1,000 tons)
- Large-Scale Power Plants (> 25 megawatts)
- Sand and Gravel Facilities (> 100 acre-feet/year)
- Metal Mining Facilities (> 500 acre-feet/year)
- Dairy Operations (monthly average $\geq$ 100 lactating cows/day)
- Cattle Feedlot Operations (monthly average > 100 beef cattle/year)
- New Large Landscape Users (> 10,000 square feet of water-intensive landscape)
- New Large Industrial Users (> 100 acre-feet/year)

Industrial users in the Pinal AMA use groundwater primarily for industrial processing, cooling, and landscape watering. Industrial users with water rights or permits accounted for about 0.5 percent of the AMA water use in 1995, or roughly 6,600 acre-feet. Industrial water use, including that by individual users, is projected to increase to approximately 24,000 acre-feet by 2025.

Each section of this chapter contains all or part of the following: an introduction, water use by the subsector, program development and issues, Third Management Plan program description, non-regulatory efforts, future directions, and subsector conservation requirements.

6.1.1 Statutory Provisions

6.1.1.1 Conservation Requirements

The Code requires that all management plans contain a conservation program for industrial users. For the third management period the director is required to establish in each plan:

> additional conservation requirements for all non-irrigation uses of groundwater to be achieved by the end of the third management period and may establish intermediate conservation requirements to be achieved at specified intervals during the third management period. . . . For industrial uses including industrial uses within the exterior boundaries of the service area of a city, town, private water company or irrigation district, the program shall require the use of or establish conservation requirements based on the use of the latest commercially available conservation technology consistent with reasonable economic return. A.R.S. § 45-566(A)(2).

6.1.1.2 Individual User Requirements

The Code also requires the establishment of additional conservation requirements for municipal uses in the Third Management Plan, including "use of such other conservation measures as may be appropriate for individual users." A.R.S. § 45-566(A)(2). (See Chapter 5.) In the First Management Plan, individual users included turf-related facilities that were regulated under the conservation requirements of the industrial program regardless of the source of water, whether from municipal providers or from a facility's own wells. Similarly, in the Second Management Plan, turf-related facilities were again identified as individual users subject to the industrial program conservation requirements. In addition, new large cooling users, which are typically served by water providers, were also regulated as individual users in the Second Management Plan. These facilities were required to comply with conservation requirements contained under the industrial program.

6.1.2 Industrial Program Development

The industrial conservation program has evolved into a more technically sophisticated program since the First Management Plan. This has been the result of considerable input and cooperation by the regulated community, as well as investigative efforts by the Department.

In the First Management Plan, the industrial program stressed water use efficiency and contained other general requirements. There were specific conservation programs only for metal mines, turf-related facilities, electric power plants, sand and gravel facilities, cattle feedlots (Pinal AMA only) and other industrial users.

As a result of several consultant studies conducted while developing the Second Management Plan, additional conservation requirements were added for new large cooling users, dairies, cattle feedlots (all AMAs), new large industrial users, and new large landscape users. In addition, there were more specific effluent incentive provisions for turf-related facilities.

In the development phase for the Third Management Plan, additional industrial conservation program categories were created for large-scale cooling facilities, new large landscape users, and new large industrial users. These three industrial water use subsectors were in the "All Industrial Users" category in the Second Management Plan but have been separated out to more clearly present the water use characteristics and specific conservation requirements for the Third Management Plan. This results in a total of 10 industrial program categories: (1) All Industrial Users, (2) Turf-Related Facilities, (3) Sand and Gravel Facilities, (4) Metal Mining Facilities, (5) Large-Scale Power Plants, (6) Large-Scale Cooling Facilities, (7) Dairy Operations, (8) Cattle Feedlot Operations, (9) New Large Landscape Users, and (10) New Large Industrial Users.

There are industrial users in all categories in the Pinal AMA except for Large-Scale Power Plants, New Large Landscape Users, New Large Industrial Users, and Large-Scale Cooling Facilities. However, the conservation requirements for all categories are presented in this chapter in the event that these uses arise or are identified during the third management period.

Industrial subsector requirements vary from allotment-based requirements to the implementation of specific conservation measures. In all cases, the requirements have been developed in an attempt to conform with "the latest commercially available conservation technology consistent with reasonable economic return." A.R.S. § 45-566(A)(2).

For the Third Management Plan, the Department reviewed the existing subsector conservation programs and tried to address any existing problems or deficiencies. The specific changes, issues, and renewable

supply incentives that were considered in subsector program development are discussed in each section of this chapter.

6.1.3 Industrial Program Issues

The Department considered a number of issues associated with the industrial conservation program as it developed the Third Management Plan. Several issues emerged that have long-term implications for industrial water use. Some issues can be addressed using existing statutory and regulatory mechanisms while others may require a statutory amendment. During the third management period, the Department will pursue opportunities to address issues requiring legislative changes.

6.1.3.1 Use of Renewable Supplies by Industrial Users

Physical access to renewable supplies is limited for most industrial users. Potential users are often far removed from the sources of supplies, and the cost of constructing delivery systems restricts utilization. Because industrial users have legal authority to withdraw groundwater from their own wells at relatively low energy costs, there is no economic incentive to incur the additional expense associated with the purchase, delivery, and possible treatment of an alternative supply.

No industrial users in the Pinal AMA hold a CAP subcontract. However, a private golf course is watered by municipal CAP water served by the Arizona Water Company - Casa Grande system, and the City of Eloy's municipal golf course is watered by municipal CAP water served by the city. Additionally, Picacho School uses excess CAP water for turf watering.

6.1.3.2 Matching Water Quality and Uses

Each industrial user category has its own water chemistry requirements related to the particular product or process involved. Some users may not require high quality water while others do. For example, turf-related facilities are able to use effluent without any significant adverse impact, and sand and gravel facilities can use effluent for aggregate washing. Use of industrial wastewater may also be a potential water supply and needs to be investigated. Constraints on use include location of the supply in relation to the facility, cost, and pre-treatment needs.

In 1997, the Legislature enacted legislation significantly revising the Water Quality Assurance Revolving Fund (WQARF) program to provide incentives for the use of remediated groundwater to facilitate the treatment of contaminated groundwater. Among other things, the WQARF legislation provides that when determining compliance with management plan conservation requirements, the Department shall account for groundwater withdrawn pursuant to approved remedial action projects under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, consistent with the accounting for surface water. Laws 1997, Ch. 287, § 51(B). See Chapter 7, section 7.4.4.6.3. Groundwater withdrawn pursuant to an approved remedial action project retains its legal character as groundwater for all other purposes under Title 45, Arizona Revised Statutes, including all other laws regulating groundwater withdrawal and use such as the assessment of withdrawal fees pursuant to A.R.S. § 45-611, *et seq.*, as well as laws regulating water exchanges as set forth in A.R.S. § 45-1001, *et seq.*, the transportation of groundwater as set forth in A.R.S. § 45-541, *et seq.*, withdrawals of groundwater for transportation to active management areas as set forth in A.R.S. § 45-551, *et seq.*, and underground water storage, savings, and replenishment as set forth in Title 45, Chapter 3.1, Arizona Revised Statutes.

For each approved remedial action project, the annual amount of groundwater that is eligible for the remediated groundwater accounting incentive is the maximum annual volume of groundwater that may be withdrawn pursuant to the project, as specified in the consent decree or other document approved by the EPA or ADEQ. However, if the project was approved prior to June 15, 1999 and the maximum annual

volume of groundwater that may be withdrawn pursuant to the project is not specified in a consent decree or other document approved by the EPA or ADEQ, the annual amount of groundwater that is eligible for the remediated groundwater accounting incentive is the highest annual use of groundwater withdrawn pursuant to the project prior to January 1, 1999. The director may modify the annual amount of groundwater that is eligible for the accounting incentive if an increase in withdrawals is necessary to further the purpose of the project or if a change is made to the consent decree or other document approved by the EPA or ADEQ.

In order to qualify for the remediated groundwater accounting incentive, a person must notify the director in writing of the anticipated withdrawal of the groundwater prior to its withdrawal. The notification must include a copy of a document approved by ADEQ or the EPA such as the Remedial Action Plan (RAP), Record of Decision (ROD) or consent decree. Unless specified in the document, the notification must include the volume of groundwater that will be pumped annually pursuant to the project, the time period to which the document applies, and the annual authorized volume of groundwater that may be withdrawn pursuant to the project. The notification must also include the purpose for which the remediated groundwater will be used and the name and telephone number of a contact person. Additionally, at the time the notice is given, the person must be using remediated groundwater pursuant to the approved remedial action or must have agreed to do so through a consent decree or other document approved by ADEQ or the EPA. Remediated groundwater which qualifies for the accounting must be metered and reported separately from groundwater that does not qualify for the accounting. (See section 6-204 of the Conservation Requirements for All Industrial Users.)

6.1.3.3 Unused Allotment

There is a large volume of unused allotment associated with the industrial sector. Water rights and permits held by industrial users in the Pinal AMA total nearly 33,000 acre-feet. While some of the unused allotment may never actually be put to use, it is not possible to predict future utilization. Type 1 grandfathered rights and some Type 2 grandfathered rights may be extinguished for assured water supply credits (mineral extraction and electric power Type 2 grandfathered rights may not be extinguished for this purpose). This mechanism provides opportunities to permanently extinguish existing industrial rights.

6.1.3.4 General Industrial Use and Mineral Extraction Permits

GIUs are issued under A.R.S. § 45-515 for industrial uses located outside of service area boundaries pursuant to certain conditions. Permits may also be issued for mineral extraction and metallurgical processing under A.R.S. § 45-514. These permits allow groundwater pumping in addition to withdrawals pursuant to existing industrial rights. Historically, permits have been readily issued and the number of permit applications may increase in the future as the availability of Type 2 grandfathered rights to serve industrial uses becomes more limited.

6.1.4 Non-Regulatory Efforts

The Department is committed to continuing its efforts during the third management period to assist regulated industrial users in meeting their conservation requirements through direct technical assistance provided by AMA staff and through conservation assistance grants. More detailed information on the Third Management Plan Water Management Assistance Program can be found in Chapter 9.

There are renewable supply use incentives in several of the industrial subsector programs. The regulatory program for turf-related facilities allows for higher water application rates if effluent is used. New large landscape users are exempt from requirements if 100 percent wastewater is used for watering. Large-scale cooling facilities are exempt from the cycles of concentration requirement if 100 percent of the blowdown water is reused. Similarly, large-scale power plants may receive a waiver of conservation requirements if

they submit and receive approval of a plan to reuse cooling water. Dairies that meter and deliver wastewater to another user are allowed to deduct that volume from their use. All facilities are exempt from conservation requirements if no groundwater is used.

6.1.5 Future Directions

Maintaining water use efficiency, providing conservation and technical assistance, and developing opportunities for renewable resource use are the most likely future directions for the industrial sector. The future of industrial users in relation to the management goal is largely shaped by the potential for growth in groundwater use and existing constraints on replacing groundwater use with renewable supplies.

In order for the industrial sector to contribute more to the achievement of the Pinal AMA goal, there needs to be continuing and enhanced water use efficiency, meaningful incentives for the use of renewable water supplies, and viable administrative and physical renewable resource use mechanisms in place. The majority of effluent use in the third management period is projected to be used by municipally-served turf-related facilities. However, there may be potential for CAP and effluent use by sand and gravel facilities and CAP use by metal mines or other facilities in the future. In order for this to occur, there must be either regional infrastructure cost sharing opportunities for direct use that make it economically viable to use a renewable supply or low cost replenishment mechanisms, whereby pumped groundwater would be replenished by a renewable supply elsewhere in the AMA under certain conditions.

Apart from the grandfathered right retirement provision in the Code and the grandfathered right extinguishment provisions in the Assured Water Supply Rules (AWS Rules), there is currently no regulatory authority that could reduce the number of grandfathered rights in the Pinal AMA. The Department has decided not to include a grandfathered right purchase and retirement program in the Third Management Plan (see Chapter 8, section 8.5.7). The extent to which the extinguishment provisions in the AWS Rules will limit industrial use is impossible to predict. It may be necessary to explore groundwater replenishment approaches to offset a portion of industrial pumpage. Expanding the authority of the Central Arizona Groundwater Replenishment District (CAGRD) to recharge excess CAP water outside of the provisions of the AWS Rules or establishing a separate replenishment authority for industrial users are possible mechanisms. Statutory change would be necessary to implement either mechanism.

A primary objective of the Third Management Plan Augmentation and Recharge Program for the Pinal AMA involves the development of a comprehensive regional recharge plan (see Chapter 8, section 8.4). Such a plan is expected to address the need for management of groundwater problems in local areas. Industrial uses in such "critical areas" may be affected by limiting the issuance of new GIU permits and new Type 1 grandfathered rights, as well as the amount of groundwater that may be used pursuant to such water rights and permits. Such restrictions would require that new statutory authorities be given to the Department.

Industrial water uses may change as new technologies are developed. Research may need to be conducted during the third management period to investigate water conserving opportunities associated with use of these technologies by certain industrial users. This research could be used to develop conservation requirements for the Fourth Management Plan.

6.2 ALL INDUSTRIAL USERS

6.2.1 Introduction

The conservation requirements in this section apply to all industrial water users. In addition, an industrial user may have to comply with specific requirements under subsequent sections of this chapter. For example, a sand and gravel facility is required to use low-flow plumbing devices at the facility to the maximum extent possible in addition to meeting its regulations under section 6.6.7 of this chapter. This section also applies to facilities, referred to as "other industrial users," that do not fit the definitions for specific industrial subsectors.

6.2.2 Water Use by "Other Industrial Users"

Other industrial users, those not regulated under subsequent sections of this chapter, accounted for about 426 acre-feet of groundwater withdrawals in the Pinal AMA during 1995. Of this amount, approximately 417 acre-feet was used by the eight largest users: those facilities using more than 20 acre-feet per year. There are 97 water rights and permits, with a total annual allotment of 9,249 acre-feet associated with this category in the AMA. Additionally, one facility, Picacho School, received 50 acre-feet of excess CAP water in 1995.

6.2.3 Program Development and Issues

The First Management Plan contained requirements for "other industrial users" but not for all industrial users. These requirements included avoiding waste, making efforts to recycle water, and a prohibition on single-pass cooling or heating. These requirements and others were included in the Second Management Plan for all industrial users.

Studies done in preparation of the Second Management Plan investigated water use associated with landscaping, heating and cooling, and sanitary and kitchen water use practices, and identified areas of conservation potential and appropriate conservation techniques. The Department concluded that the findings from consultant studies of industrial uses for the Second Management Plan still apply to current industrial use and practices. In addition, a 1996-97 Tucson AMA conservation assistance grant investigated water use practices at cooling towers and yielded additional information on water conservation potential.

These studies resulted in the following recommended techniques for achieving water conservation in the industrial sector:

- reusing or recycling water
- avoiding single pass cooling unless the water is reused
- use of low-flow plumbing fixtures
- use of low water use landscaping with efficient irrigation systems
- developing site-specific water conservation plans for large facilities

Most of these techniques are included in the conservation requirements for all industrial users detailed below and apply equally to "other industrial users," including those with specific requirements.

The Department also inventoried the "other industrial user" category during the planning period for the Third Management Plan to determine if there were any user subsectors with sufficient usage and conservation potential to warrant specific conservation requirements. The Department found that the greatest conservation potential within the "other industrial users" category is in small cooling towers and landscape watering.

6.2.4 All Industrial Users Conservation Program

The Third Management Plan conservation program for all industrial users is similar to the Second Management Plan program. All industrial users are required to avoid waste and make diligent efforts to recycle water. Single-pass cooling or heating is not allowed unless the water is reused and low-flow plumbing fixtures must be used where feasible. Since January 1, 1994, the Arizona Statewide Plumbing Code has required use of low-flow fixtures in new construction throughout the state and some local plumbing ordinances have even more stringent standards.

There are two landscaping requirements included for the third management period. For an industrial user not regulated as a turf-related facility or a new large landscape user, there is a requirement to use low water use landscape plants for landscaping where feasible and water with efficient irrigation systems. Improving irrigation efficiency can be a source of major water savings whether the plants have high or low water needs. The Department encourages all facilities to apply water efficiently regardless of the type of vegetation planted. In addition, industrial users are prohibited from serving groundwater to vegetation planted in a public right-of-way after January 1, 2002 unless the plants are on the Drought Tolerant/Low Water Use Plant List, or any modifications to the list, for the AMA (see Appendix 5I) and are prohibited from serving groundwater to a water feature in the right-of-way if installed after January 1, 2002.

6.2.5 Industrial Conservation Requirements and Monitoring and Reporting Requirements for All Industrial Users

6-201. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases used in sections 6-202 through 6-203 of this chapter shall have the following meanings:

1. *"Industrial process purposes" means water which is used by an industrial user directly in the creation or manufacture of a product.*

2. *"Industrial use" means a non-irrigation use of water not supplied by a city, town, or private water company, including animal industry use and expanded animal industry use.*

3. *"Industrial user" means a person who uses water for industrial uses.*

4. *"Low-flow plumbing fixture" means a lavatory faucet, lavatory faucet replacement aerator, kitchen faucet, kitchen faucet replacement aerator, shower head, urinal, water closet, or evaporative cooler designed to meet the use rates specified in A.R.S. §§ 45-312 and 313 or the applicable county or city code, whichever is more restrictive.*

5. *"Single-pass cooling and heating" means the use of water without recirculation to increase or decrease the temperature of equipment, a stored liquid, or a confined air space.*

6. *"Wastewater" means water that is discharged after an industrial or municipal use, excluding effluent.*

6-202. Conservation Requirements

Beginning on January 1, 2002 or upon commencement of water use, whichever is later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management Plan, an industrial user shall comply with the following requirements:

1. *Avoid waste; use only the amount of water from any source, including effluent, reasonably required for each industrial use; and make diligent efforts to recycle water.*

2. *Do not use water for non-residential single-pass cooling or heating purposes unless the water is reused for other purposes.*

3. *Use low-flow plumbing fixtures as required by Title 45, Chapter 1, Article 12, Arizona Revised Statutes, or any applicable county or city code, whichever is more restrictive.*

4. *Use plants listed in Appendix 5I (Drought Tolerant/Low Water Use Plant List, or any modifications to the list) for landscaping to the maximum extent feasible, and water with a water efficient irrigation system. An industrial user regulated as a turf-related facility under sections 6-301, et seq., or as a new large landscape user under section 6-1001, et seq., is exempt from this requirement.*

5. *Do not serve or use groundwater for the purpose of watering landscaping plants planted on or after January 1, 2002 within any publicly owned right-of-way of a highway, street, road, sidewalk, curb, or shoulder which is used for travel in any ordinary mode, including pedestrian travel, unless the plants are listed on the Drought Tolerant/Low Water Use Plant List for the Pinal AMA (Appendix 5I), or any modifications to the list. The director may waive this requirement upon request from the industrial user if a waiver is in the public interest. This requirement does not apply to any portion of a residential lot that extends into a publicly owned right-of-way.*

6. *Do not serve or use groundwater for the purpose of maintaining water features, including fountains, waterfalls, ponds, water courses, and other artificial water structures, installed after January 1, 2002 within any publicly owned right-of-way of a highway, street, road, sidewalk, curb, or shoulder which is used for travel in any ordinary mode, including pedestrian travel. The director may waive this requirement upon request from the industrial user if a waiver is in the public interest. This requirement does not apply to any portion of a residential lot that extends into a publicly owned right-of-way.*

6-203. Monitoring and Reporting Requirements

A. Requirements

For calendar year 2002 or the calendar year in which the facility first begins to use water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the Fourth Management Plan, an industrial user shall, except as provided for in subsection B of this section, include the following information in its annual report required by A.R.S. § 45-632:

1. *The total quantity of water by source, including effluent, withdrawn, diverted, or received during the reporting year for industrial process purposes, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

2. *The total quantity of water by source, including effluent, withdrawn, diverted, or received during the reporting year for purposes other than industrial process purposes, listed in paragraph 1 of this subsection, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

3. *An estimate of the quantity of wastewater generated during the reporting year.*

4. *An estimate of the quantity of wastewater recycled during the reporting year.*

5. *A description of the primary purposes for which water from any source, including effluent, is used.*

6. *The number of acres of land that were planted with low water use plants during the calendar year as a result of removal of plants not on the Drought Tolerant/Low Water Use Plant List, or any modifications to the list, for the Pinal AMA, if more than one acre, and the method of irrigation for those acres. An industrial user regulated as a turf-related facility under sections 6-301, et seq., or as a new large landscape user under section 6-1001, et seq., is exempt from this requirement.*

B. Exemption

An industrial user who holds a Type 1 or Type 2 non-irrigation grandfathered right or a groundwater withdrawal permit in the amount of 10 or fewer acre-feet per year is exempt from the requirements set forth in subsection A of this section, unless the industrial user holds more than one such right or permit in the aggregate amount of more than 10 acre-feet per year and withdraws more than 10 acre-feet of water during the calendar year pursuant to those rights or permits.

6-204. Remediated Groundwater Accounting for Conservation Requirements

A. Accounting

Groundwater withdrawn pursuant to an approved remedial action project under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, and used by a person subject to a conservation requirement established under this chapter, shall be accounted for consistent with the accounting for surface water for purposes of determining the person's compliance with the conservation requirement, subject to the provisions of subsections B through D of this section.

B. Amount of Groundwater Eligible for Accounting

For each approved remedial action project, the annual amount of groundwater that is eligible for the remediated groundwater accounting provided in subsection A of this section is the project's annual authorized volume. The annual authorized volume for a remedial action project approved on or after June 15, 1999 is the maximum annual volume of groundwater that may be withdrawn pursuant to the project, as specified in a consent decree or other document approved by the United States Environmental Protection Agency (EPA) or the Arizona Department of Environmental Quality (ADEQ). The annual authorized volume for a project approved prior to June 15, 1999 is the highest annual use of groundwater withdrawn pursuant to the project prior to January 1, 1999, except that if a consent decree or other document approved by the EPA or ADEQ specifies the maximum annual volume of groundwater that may be withdrawn pursuant to the project, the project's annual authorized volume is the maximum annual volume of groundwater specified in that document. The director may modify the annual authorized volume for a remedial action project as follows:

1. *For an approved remedial action project associated with a treatment plant that was in operation prior to June 15, 1999, a person may request an increase in the annual authorized volume at the same time the notice is submitted pursuant to subsection C of this section. The director shall increase the annual authorized volume up to the maximum treatment capacity of the treatment plant if adequate documentation is submitted to the director demonstrating that an increase is necessary to further the purpose of the remedial action project and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.*

2. *A person may request an increase in the annual authorized volume of an approved remedial action project at any time if it is necessary to withdraw groundwater in excess of the annual authorized volume to further the purpose of the project. The director shall increase the annual authorized volume up to the maximum volume needed to further the purpose of the project if adequate documentation justifying the increase is submitted to the director and the increase is not in violation of the consent decree or other document approved by the EPA or ADEQ.*

3. *The director shall modify the annual authorized volume of an approved remedial action project to conform to any change in the consent decree or other document approved by the EPA or ADEQ if the person desiring the modification gives the director written notice of the change within thirty days after the change. The notice shall include a copy of the legally binding agreement changing the consent decree or other document approved by the EPA or ADEQ.*

C. Notification

To qualify for the remediated groundwater accounting provided in subsection A of this section, the person desiring the accounting must notify the director in writing of the anticipated withdrawal of groundwater pursuant to an approved remedial action project under CERCLA or Title 49, Arizona Revised Statutes, prior to the withdrawal. At the time the notice is given, the person desiring the accounting must be using remediated groundwater pursuant to the approved remedial action project or must have agreed to do so through a consent decree or other document approved by the EPA or ADEQ. The notice required by this subsection shall include all of the following:

1. *A copy of a document approved by ADEQ or the EPA, such as the Remedial Action Plan (RAP), Record of Decision (ROD) or consent decree, authorizing the remediated groundwater project. Unless expressly specified in the document, the person shall include in the notice the volume of groundwater that will be pumped annually pursuant to the project, the time period to which the document applies, and the annual authorized volume of groundwater that may be withdrawn pursuant to the project.*

2. *The purpose for which the remediated groundwater will be used.*

3. *The name and telephone number of a contact person.*

4. *Any other information required by the director.*

D. Monitoring and Reporting Requirements

To qualify for the remediated groundwater accounting for conservation requirements as provided in subsection A of this section, groundwater withdrawn pursuant to the approved remedial action project must be metered separately from groundwater withdrawn in association with another groundwater withdrawal authority for the same or other end use. A person desiring the remediated groundwater accounting for conservation requirements shall indicate in its annual report under A.R.S. § 45-632 the volume of water withdrawn and used during the previous calendar year that qualifies for the accounting.

6.3 TURF-RELATED FACILITIES

6.3.1 Introduction

Turf-related facilities are those industrial users that apply water to 10 or more acres of water-intensive landscaped area, including golf courses, parks, schools, cemeteries, and common areas within residential developments. Because "irrigation" is defined in the Code as water applied for the purpose of growing crops for sale or consumption, turf-related watering for recreational and aesthetic purposes is considered a non-irrigation water use.

Turf-related facilities regulated under the industrial conservation program obtain groundwater pursuant to Type 1 or Type 2 grandfathered rights, groundwater withdrawal permits, or recovery permits. In addition, a large number of turf-related facilities are served groundwater by municipal water providers and are also subject to the conservation requirements set forth in this section through provisions of the municipal conservation program (see Chapter 5). These facilities are classified as individual users.

Second Management Plan conservation requirements and other factors have driven changes in turf-related facilities. New facilities are designed with less water-intensive acreage; both existing and new facilities employ technology that applies water more efficiently and facility management has become more cognizant of the need for water conservation.

6.3.2 Water Use by Turf-Related Facilities

Turf-related facilities apply water for growing turfgrass and other landscaping plants and for filling and maintaining water levels in bodies of water. There are 21 turf-related facilities (both industrial users and others) in the Pinal AMA, including golf courses, schools, and a common area. Residential developments having common areas and cemeteries with 10 or more acres of water-intensive landscaping are subject to regulation as turf-related facilities, but none have been identified in the AMA.

In 1995, turf-related facilities encompassed nearly 902 acres of turf and more than 100 surface acres of water in the Pinal AMA. Golf courses are the largest of the turf-related facilities, with most courses having more than 80 acres of water-intensive landscaping. Schools make up the smallest regulated facilities, consisting of 10 to 20 acres of turf. The bodies of water associated with turf-related facilities are most often constructed on golf courses, although the AMA does have a common area with a lake, which encompasses nearly 14 surface acres.

Turf-related facility water use in the Pinal AMA has increased from 2,131 acre-feet in 1987 to 4,285 acre-feet in 1995. While total water use has increased, it continues to be below the total maximum annual water allotment for turf-related facilities of 4,919 acre-feet. Two golf courses in the AMA have chosen to be served entirely with renewable supplies and therefore are not regulated by the Department. These facilities, however, are accounted for in the total water use by turf-related facilities in order to provide a more accurate portrayal of water use.

6.3.3 First and Second Management Plan Program Development

The First Management Plan requirements limited the total water allotment for each facility and stressed water use efficiency. This was the first time golf course water use was regulated, and water management practices, such as evapotranspiration-based water application scheduling, were uncommon. The allotment approach permitted turf managers to consider characteristics of the facility, evaluate conservation alternatives, and decide how to most effectively apply the allotment to meet the facility's needs. The First Management Plan provided for adjustment of turf application rates if effluent was used.

There was a trend in the AMAs throughout the first management period to convert turf-related facilities from groundwater to reclaimed water use. The Department encouraged the use of effluent. Under certain circumstances, turf-related facilities using effluent were given a higher application rate. The exclusion of effluent deliveries from the gallons per capita per day calculation in the municipal conservation program also served as an incentive to providers to serve effluent to turf-related facilities when available.

Development of the Second Management Plan conservation requirements involved extensive data collection regarding water use patterns in central Arizona and the conservation options available to turf-related facility managers. The Department relied heavily on input from the Turf Advisory Committees in the Phoenix and Tucson AMAs, as well as that of a private consultant. The consultant and the advisory committees concluded that a combination of good management and the latest water application systems was shown to be very effective in reducing water use.

For the Second Management Plan, the Department chose not to require specific conservation techniques wherever possible due to the widely varied nature of turf-related facilities. Instead, the approach for the First Management Plan was continued and turf-related facilities were given a maximum annual water allotment based upon the use of conservation techniques. The Second Management Plan included an overall decrease in application rates for all turf-related facilities, limits on water-intensive landscaping for golf courses and cemeteries, plus more specific effluent incentives. Water use figures and other data collected from over 400 turf-related facilities in all of the AMAs were used in determining annual water allotments.

Based on a variety of scientific data, the Department established annual application rates in the Pinal AMA of 4.8 acre-feet per acre per year for turf acres, 6.2 acre-feet per acre for bodies of water, and 1.5 acre-feet per acre for low water use landscaping. The Second Management Plan also exempted effluent-filled lakes from a limitation on golf course water surface acreage. The Department allowed for adjustments in application rates when establishing new turf, using high salinity water, filling or refilling bodies of water, and revegetating acreage disturbed during construction. In addition, the Second Management Plan allowed turf-related facilities a three-year averaging method to compensate for weather fluctuations when determining a facility's compliance with its conservation requirement.

6.3.4 Third Management Plan Issues and Development

The Code provides that the conservation program for industrial users shall require the use of established conservation requirements based on the latest commercially available and economically feasible water conservation technologies. For turf-related facilities, such technologies include: (1) the use of weather-based water application scheduling and water budgeting; (2) accurate, well-designed sprinkler heads and computerized control mechanisms; (3) golf course design that concentrates water-intensive landscaping in those areas that come into play; and (4) PVC lake liners. Using new low water use and drought tolerant turfgrasses, improving conservation knowledge and awareness by facility management, and converting industrial users to renewable supplies are ways turf-related facilities could further contribute to the management goal of the AMA.

Technical Advisory Committees (TACs) in the Phoenix and Tucson AMAs have contributed to the development of the Third Management Plan's conservation program for turf-related facilities. In some cases, subcommittees were formed to address a specific issue and to make a program recommendation to the committee as a whole. These committees and the Department identified the following issues of relevance:

- the allotment methodology and application rates
- weather adjustment
- renewable supply incentives

6.3.4.1 Allotment Methodology and Application Rates

The Second Management Plan turf application rate of 4.8 acre-feet per acre per year applied to all turf-related facilities. For most golf courses constructed after 1985, the maximum annual water allotment was limited to 24.8 acre-feet per hole. During Third Management Plan development, some representatives of the golf industry argued that this limitation denied golf courses their legal right to sufficient groundwater to meet their actual needs consistent with their selected business practices. They felt that the Department's program unreasonably preempted the complete overseeding of golf courses, interfered with reasonable management of longer courses needed to attract high-visibility tournaments, and resulted in target-style courses that imposed unreasonable skill demands on inexperienced and older players. They asserted that the allocations were not supported by sufficient data. Other TAC members felt that the application rates and allotment limitations were supported by scientific research and, that while potentially challenging to superintendents and designers, the allotments were adequate assuming the use of high-quality water application systems and conscientious water management practices.

Factors influencing turf watering needs include temperature, solar radiation, humidity, wind, and soil moisture. Based on research conducted at the University of Arizona Desert Turf Research Center (Brown, Gilbert, and Kopec, 1996) and 1988 to 1996 weather data from the Arizona Meteorological Network, high-quality turf with winter overseeding would need to be irrigated with 4.5 to 5.2 acre-feet per acre per year of water applied depending upon the weather conditions of that year, not including rainfall. This research supports the adequacy of the Second Management Plan's 4.8 acre-feet per acre per year application rate for maintaining overseeded turf.

The parameters assumed in the research are conditions that may lead to a long-term root zone salt accumulation, depending upon the quality of the water applied to turf. Additional investigation is needed to determine if typical rainfall distribution will adequately flush accumulated salts beyond the turfgrasses' root zone or, if rainfall is not sufficient, if continuous water application at a slightly higher rate or periodic flushing at a much higher application rate would best balance salt management and water application efficiency.

Because of regional variation in rainfall, wind speed during watering times, soil type, root zone depth, and course topography can all have potential negative impacts on turf water demand, application rates deemed sufficient for the majority of facilities were agreed upon by the TACs. Individual facilities with special circumstances that could render these application rates unreasonable can seek relief through an administrative review. A.R.S. § 45-575.

The Third Management Plan allotment methodology allows target-type courses to apply water to turf at a higher application rate than the 4.8 acre-feet per acre per year application given for turf acres. Under the Third Management Plan, some or all low water use landscaping will qualify for this application rate if the amount of turf is less than five acres per hole. If low water use landscaping is well-designed and carefully managed to take maximum advantage of rainfall, overspray, and the turf application rate, most of the allocation that is provided for low water use acreage may be applied to turf acres.

Historic water use and research in California indicates that the higher unirrigated perimeter to turfed acre ratios, typical of target-style courses, may result in higher water demand per acre than that of more traditionally designed courses. Increased evapotranspiration may occur with 200 feet of perimeters adjacent to unweathered or low water use areas. On narrow fairways these zones may coincide, and water demand for the entire turfed area may increase on the order of 5 percent. In order to sufficiently quantify this effect for possible inclusion in management plan requirements, additional research needs to be conducted in the desert regions of Arizona.

6.3.4.2 Weather Adjustment

Historically, rainfall in the Pinal AMA tends to be cyclic, with "dry" or "wet" periods that may last as long as four or five years. Evapotranspiration and rainfall measurements since 1992 indicate that the three-year averaging provision of water use to compensate for weather variation in the Second Management Plan may not be adequate. Late and/or sparse summer rainfall in 1993 and 1994 exhausted allotment savings gained in 1992, the last wet year in the AMA. Although evapotranspiration probably doesn't vary more than about 10 percent over the AMA in any one year, rainfall is extremely variable. Long-term weather observations indicate that the average rainfall for similar sites throughout the AMA is about the same, but in a given year, rainfall at different points may vary substantially.

Alternatives considered by the TACs for the Third Management Plan for improving an inadequate weather adjustment in the Second Management Plan included a flexibility account or a five-year averaging provision. The Department opted for a flexibility account for the Third Management Plan that contains both credit and debit limits. The account would encourage and reward careful management through the accrual of credits. Credit and debit limits on the flexibility account were set at 20 percent of the maximum annual water allotment.

6.3.4.3 Renewable Supply Incentives

The Pinal AMA does not have a regional reclaimed water system, which constrains effluent availability for turf-related facilities. While the capacity of wastewater treatment plants in the AMA is increasing, the distribution systems from these plants are limited. Facilities in close proximity to these plants are able to utilize effluent. Effluent use in the AMA, however, will continue to be constrained by the lack of an extensive infrastructure to deliver the water.

The Department and TACs discussed several incentives that would further encourage effluent use for facilities provided by municipalities and industrial users. Because effluent is an underutilized supply, the Department chose to discount all direct effluent use by 30 percent. The incentive will provide a significant discount to encourage effluent use where supplies are expensive and to encourage and reward the construction of wastewater treatment plants to produce effluent in new developments. The incentives acknowledge the need for water use efficiency and conservation by reducing the discount at higher percentages of use, while allowing for higher application rates for facilities using a higher percentage of effluent. The 30 percent effluent discount will allow a typical golf course to apply an amount of water equivalent to the average reference evapotranspiration rate when effluent use is maximized.

The Department and the TACs explored incentives for the use of other non-groundwater supplies. Because efforts by the Arizona Water Banking Authority to fully utilize CAP water are expected to be successful in importing excess CAP supplies into the Pinal AMA, additional incentives are not needed.

6.3.5 Turf-Related Facilities Conservation Program

6.3.5.1 Maximum Annual Water Allotment

The turf conservation program is based on a maximum annual water allotment for each facility. The calculation of allotments is determined by the type of facility. In most cases, there is a direct relationship between the number of acres of turf and artificial lakes and the size of the allotment. For all turf-related facilities, the annual application rate for turf acres is 4.8 acre-feet per acre, the application rate for water surface acres is 6.2 acre-feet per acre, and the application rate for low water use landscaped area is 1.5 acre-feet per acre. The allotment for schools, parks, cemeteries, and common areas is calculated by multiplying acreage by the appropriate application rates shown in Table 6-1. The approach used for these facilities allows expansion of water-intensive landscaped area.

In developing the water allotment formula for golf courses, the Department recognized that the latest conservation technology includes course design that concentrates water-intensive landscaping to areas that come into play, and management practices that adjust water application schedules for weather conditions and seasons of highest play.

Post-1985 golf courses will receive annual water allotments based on the same formula use for other turf-related facilities, up to a maximum of 24 acre-feet per hole for turf and low water use landscaped area. The Third Management Plan allows for an allotment addition for turf and low water use landscape in excess of 24 acre-feet per hole, if effluent will eventually be used on the excess acreage. The allotment for bodies of water on new golf courses that are not entirely filled with direct use effluent or effluent recovered within the area of impact is not to exceed an allotment for more than 0.14 acres per hole. Although the allotment is calculated on a per acre basis, the application of allotment is at the discretion of the facility manager.

Allotments for pre-1986 golf courses are calculated based upon historic acreage of turf, water surface, and low water landscaping. However, any additions to such golf courses are constrained by the same allotment as post-1985 golf courses.

6.3.5.2 Reduction of Turfed Acreage

Conservation requirements for the second management period also provide an incentive to reduce turfed acreage. The annual water allotment for a turf-related facility is based on the maximum area of turf and lakes developed at each facility during the first management period. If historic turfed acreage, low water use landscaped area, or total water surface area is removed, the allotment does not decrease. Schools, parks, cemeteries, and common areas of housing developments are encouraged to minimize the areas landscaped with water-intensive plants.

6.3.5.3 Allotment Adjustment for Revegetation

A revegetation allotment is necessary for facilities that want to establish native or low water use vegetation. This allotment, up to 1.5 acre-feet per acre, is limited to a maximum of three calendar years, after which no additional allotment will be made. The allotment is on an application basis with the quantity and duration to be determined by the Department.

6.3.5.4 Allotment for Filling Bodies of Water

Turf-related facilities may apply to the Department for a one-time allotment adjustment to fill new bodies of water within the facility during the year that the lakes are filled. The allotment will be equal to the volume of the lake. Any facility may apply for an allotment adjustment to refill a body of water that has been emptied for maintenance work to eliminate or reduce seepage losses. This allotment addition may be given only for the year in which the body of water is refilled.

6.3.5.5 Allotment Adjustment for Leaching

When high levels of total dissolved solids are present in the water supply, a turf-related facility may need an additional amount of water for leaching, or deeper percolation, to prevent salts from accumulating in the root zone. If salts are allowed to accumulate in the soil, salinity will eventually reach levels that are toxic to turfgrass. Because most water supplies in the Pinal AMA are of a quality that does not require a leaching allowance, a leaching allowance was not included in the maximum annual water allotment calculation. However, should a facility's water supply have an electrical conductivity of water used (EC_w) value greater than 1.5 millimhos per centimeter (a concentration of approximately 1,000 milligrams per

liter (mg/l) of total dissolved solids), the turf-related facility may apply to the Department for an allotment adjustment for leaching.

6.3.5.6 Additional Conservation Requirements

A conservation plan will be required from all post-1985 turf-related facilities. The plan must outline the practices and technologies the facility will use to maximize its water use efficiency. All turf-related facilities that are not golf courses or cemeteries are required to construct and maintain their facilities so that areas landscaped with water-intensive plants are minimized. Golf courses have a maximum annual water allotment that assumes water-efficient management. Cemeteries may not landscape more than 75 percent of the total cemetery area within any portion of the cemetery not in operation or substantially commenced after December 31, 1985 with plants that are not on the Drought Tolerant/Low Water Use Plant List (see Appendix 5I), or any modifications to the list. This restriction does not apply to an expansion of a cemetery onto contiguous land that was under the same ownership as the cemetery as of December 31, 1985.

6.3.5.7 Effluent Use Adjustment

To encourage the maximum use of effluent on turf-related facilities during the third management period, the Department has modified the effluent incentive offered in the Second Management Plan. While a facility's annual allotment does not change, each acre-foot of effluent will be counted as 0.7 acre-foot when compliance with the maximum annual water allotment is determined. This adjustment does not apply to effluent stored in a storage facility pursuant to a water storage permit and recovered outside of the area of impact of the stored water.

6.3.5.8 Flexibility Account

In order to compensate for varying weather conditions year to year, turf-related facilities will have a flexibility account with credit and debit limits. In wetter years or through careful management, facilities will be able to accrue a credit balance up to 20 percent of a facility's allotment. When weather conditions or water management decisions cause a facility's water use to exceed its allotment in any year, accrued credits are expended. If all credits are exhausted, a facility may accrue a debit balance up to 20 percent of its allotment. Only when a facility exceeds its allotment and cannot accrue anymore debits will an allotment violation occur.

6.3.5.9 Monitoring and Reporting Requirements

The Third Management Plan includes additional monitoring and reporting requirements for turf-related facilities. All turf-related facility water use will be assumed to be for landscape watering purposes unless non-landscape water is metered separately.

6.3.6 Non-Regulatory Efforts

In 1991, the Department initiated a grants program for conservation assistance and augmentation of water supplies in the AMAs. Individual AMA programs focus on the areas of highest water conservation potential in each water use sector (agricultural, municipal, and industrial) based on total water usage, current water usage practices, and potential for implementation of new conservation technologies. Funding for the program comes from an annual withdrawal fee collected from all regulated groundwater users in the AMA.

Since 1991, over $70,000 has been awarded in the AMAs under the grants program to assist turf-related facilities through evaluation and implementation of conservation strategies. Funded projects include water

application scheduling workshops for facility managers, a public school water application system audit and repair program, electronic over watering controller field testing, and a water application field study that compared turf water demand under high and low traffic conditions.

During the third management period, the Department will continue to assist turf-related facilities in meeting their conservation requirements through direct staff assistance and through the grants program. See Chapter 9 for a description of the Water Management Assistance Program for the Third Management Plan.

6.3.7 Future Directions

Management plan conservation requirements can reduce groundwater use only to the extent that the requirements are consistent with reasonable economic return. Increased utilization of renewable water supplies combined with efforts to maximize water application efficiency become key factors in meeting the AMA's water management goal.

A change to the statutes that would allow the CAGRD to replenish mined groundwater not associated with the demonstration of an assured water supply would expand the roles of the replenishment district and the Department in replenishment and recharge activities. Such legislation would establish a foundation for a replenishment obligation for all or a portion of mined groundwater used by turf-related facilities, facilitating greater utilization of renewable supplies and reducing groundwater overdraft.

A stronger conservation component through conservation technology and water management practice requirements should be considered from both the regulatory and non-regulatory approaches. From a regulatory perspective, application rates that determine the maximum annual water allotments need to be further scrutinized under actual field conditions. Conservation technologies and practices should be further evaluated as regulatory alternative to enforceable allotments. From a non-regulatory approach, development of incentive programs should also be continued during subsequent management periods. If necessary, efforts to broaden participation in water storage and recovery options could be continued as well.

6.3.8 Industrial Conservation Requirements and Monitoring and Reporting Requirements for Turf-Related Facilities

6-301. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45, Arizona Revised Statutes, and section 6-201 of this chapter, the following words and phrases used in sections 6-301 through 6-305 of this chapter, unless the context otherwise requires, shall have the following meanings:

1. *"Body of water" means a constructed body of water or interconnected bodies of water, including a lake, pond, lagoon, or swimming pool, that has a surface area greater than 12,320 square feet when full and that is filled or refilled primarily for landscape, scenic, recreational purposes, or regulatory storage.*

2. *"Common area" means an area or areas which is owned and operated as a single integrated facility and which is used for recreational or open space purposes. A common area is maintained for the benefit of the residents of a housing development.*

3. *"Contiguous" means in contact at any point or part of the same master-planned community. Two parcels of land are contiguous even if they are separated by one or more of the following: a road, easement, or right-of-way.*

4. *"Direct use effluent" means effluent transported directly from a facility regulated pursuant to Title 49, Chapter 2, Arizona Revised Statutes, to an end user. Direct use effluent does not include effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes.*

5. *"Effluent recovered within the area of impact" means effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes, and recovered within the stored effluent's area of impact. For purposes of this definition, "area of impact" has the same meaning as prescribed by A.R.S. § 45-802.01.*

6. *"Golf course" means a turf-related facility used for playing golf with a minimum of nine holes and including any practice areas.*

7. *"Hole" means a component of a golf course consisting at a minimum of a tee and a green. A practice area or driving range is not a hole.*

8. *"Landscape watering" means the application of water from any source, including effluent, to a water-intensive landscaped area, a low water use landscaped area, or revegetation acres within a turf-related facility.*

9. *"Low water use landscaped area" means an area of land of at least one acre in aggregate, which is an integral part of a turf-related facility, which is watered by a permanent water application system and which is planted primarily with plants listed in Appendix 5I, Drought Tolerant/Low Water Use Plant List, or any modifications to the list. Mature vegetation planted in a low water use landscaped area must cover at least 50 percent of the area.*

10. *"Newly turfed area" means, for a calendar year, an area of land planted with a warm-season grass species which was not planted with a warm-season grass species during the preceding calendar year.*

11. *"Overseeded area" means, for a calendar year, an area of land planted with any cool-season grass species that grows over a dormant warm-season grass species during the fall-winter period.*

12. *"Post-1985 turf-related facility" means a turf-related facility that was neither in operation as of December 31, 1985 nor substantially commenced as of December 31, 1985.*

13. *"Pre-1986 turf-related facility" means a turf-related facility that was either in operation as of December 31, 1985 or substantially commenced as of December 31, 1985, and includes any expanded of modified portion of such a facility.*

14. *"Regulation golf course" means a golf course of at least 18 holes that is 6,200 yards or more in length per 18 holes as measured from back of the tee ground furthest from the green down the center line of the hole to the center of the green.*

15. *"Substantially commenced" means that all pre-construction permits and approvals required by federal, state, or local governments have been obtained or substantial capital investment has been made in the physical on-site construction.*

16. *"Total cemetery area" means an area of land being used for cemetery-related purposes, including any area of land covered by grave markers or by cemetery-related buildings, walks, pathways, and landscaping, but not including roads, parking lots, and any areas of land being held for future expansion of the cemetery.*

17. *"Turf acres" means an area of land that is watered with permanent water application system and planted primarily with plants not listed in Appendix 5I, Drought Tolerant/Low Water Use Plant List, or any modifications to the list.*

18. *"Turf-related facility" means any facility, including cemeteries, golf courses, parks, schools, or common areas within housing developments, with a water-intensive landscaped area of 10 or more acres. Turf-related facilities include, but are not limited to, those facilities listed in Appendix 6A.*

19. *"Water-intensive landscaped area" means, for a calendar year, the turf acres and the water surface acres within a turf-related facility.*

20. *"Water surface acres" means the total surface area of all bodies of water that are an integral part of the water-intensive landscaped area of a turf-related facility. Bodies of water used primarily for swimming purposes are not an integral part of the water-intensive landscaped area of a turf-related facility.*

6-302. Conservation Requirements for Turf-Related Facilities

A. Maximum Annual Water Allotment

Beginning with calendar year 2002 or the calendar year in which landscape watering commences, whichever is later, and for each calendar year thereafter until the effective date

of any substitute conservation requirement in the Fourth Management Plan, an industrial user who uses water at a turf-related facility shall not withdraw, divert, or receive water for landscape watering purposes at the turf-related facility during a year in an amount which exceeds the turf-related facility's maximum annual water allotment for the year as calculated in section 6-303.

B. Conservation Plan for Post-1985 Turf-Related Facilities

No later than January 1, 2002 or 180 days after receiving official notice of these conservation requirements, whichever occurs later, an industrial user who uses water at a post-1985 turf-related facility shall have prepared an accurate and detailed description of the conservation technologies, including management practices, that a facility uses in the delivery of water for landscape watering purposes. The industrial user shall maintain the plan until the first compliance date for any substitute requirement in the Fourth Management Plan.

C. Limiting Water-Intensive Landscaped Area

1. *Beginning on January 1, 2002 or upon commencement of landscape watering, whichever occurs later, and continuing until the effective date of any substitute requirement in the Fourth Management Plan, an industrial user who uses water at a turf-related facility that is not a cemetery or a golf course shall design, construct, and maintain the grounds of the facility in a manner that minimizes the water-intensive landscaped area of the facility consistent with the use of the facility. All of the facility's water-intensive landscaping shall be planted in those areas directly associated with the turf-related facility's primary purposes.*

2. *Beginning on January 1, 2002 or upon commencement of landscape watering, whichever is later, and continuing until the effective date of any substitute conservation requirement in the Fourth Management Plan, an industrial user who uses water at a turf-related facility that is a cemetery shall limit the water-intensive landscaped area within any portion of the facility that was neither in operation as of December 31, 1985 nor substantially commenced as of December 31, 1985 so that no more than 75 percent of the total cemetery area within that portion of the cemetery is planted with plants not listed in Appendix 5I, Drought Tolerant/Low Water Use Plant List, or any modifications to the list. This requirement shall not apply to any expanded portion of a cemetery in operation as of December 31, 1985 or substantially commenced as of December 31, 1985 if the expanded portion of the cemetery was under the same ownership as the cemetery as of December 31, 1985.*

6-303. Calculation of Maximum Annual Water Allotment for Turf-Related Facilities

A. Turf-Related Facilities that are Not Golf Courses

For each calendar year, the maximum annual water allotment for a turf-related facility that is not a golf course shall be calculated by determining the number of acres in existence within the facility during the calendar year in each of the categories listed in Table 6-1 and then multiplying the number of acres in each category by the applicable application rate for each category as set forth in Table 6-1. The sum of the products, plus any allotment additions allowed pursuant to subsection D of this section, is the facility's maximum annual water allotment for the calendar year.

B. Pre-1986 Turf-Related Facilities that are Golf Courses

For each calendar year, the maximum annual water allotment for a pre-1986 turf-related facility that is a golf course shall be calculated by determining the number of acres in existence within the facility during the calendar year in each of the categories listed in Table 6-1 and then multiplying the number of acres in each category by the applicable application rate for each category as set forth in Table 6-1. The sum of the products, plus any allotment adjustments allowed pursuant to subsection D of this section, is the facility's maximum annual water allotment for the year, subject to the following limitations:

1. *In determining the number of water surface acres in existence within the facility during the calendar year, the total surface area of any bodies of water added to the facility after December 31, 1985 and not filled and refilled exclusively with direct use effluent or effluent recovered within the area of impact shall be limited to an area calculated by multiplying the number of holes added to the facility after December 31, 1985 by 0.14 acre per hole. For purposes of this paragraph, a body of water filled and refilled pursuant to an interim water use permit issued under A.R.S. § 45-133 shall be deemed to be filled and refilled exclusively with direct use effluent or effluent recovered within the area of impact if the body of water will be filled and refilled exclusively with one of those types of effluent after the permit expires.*

2. *The total allotment for any turf acres and low water use landscaped area added to the facility after December 31, 1985 shall not exceed an amount calculated by multiplying the number of holes added to the facility after December 31, 1985 by 24.0 acre-feet of water per hole, plus any allotment additions allowed under subsection D of this section.*

C. Post-1985 Turf-Related Facilities that are Golf Courses

The maximum annual water allotment for a post-1985 turf-related facility that is a golf course shall be calculated by determining the number of acres in existence within the facility during the calendar year in each of the categories listed in Table 6-1 and then multiplying the number of acres in each category by the applicable application rate for each category as set forth in Table 6-1. The sum of the products, plus any adjustments allowed pursuant to subsection D of this section, is the facility's maximum annual water allotment for the calendar year, subject to the following limitations:

1. *In determining the number of water surface acres in existence within the facility during the year, the total surface area of all bodies of water not filled and refilled exclusively with direct use effluent or effluent recovered within the area of impact shall be limited to an area calculated by multiplying the number of holes present within the facility during the year by 0.14 acre per hole. For purposes of this paragraph, a body of water filled and refilled pursuant to an interim water use permit issued under A.R.S. § 45-133 shall be deemed to filled and refilled exclusively with direct use effluent or effluent recovered within the area of impact if the body of water will be filled and refilled with such water after the permit expires.*

2. *The total allotment for turf acres and low water use landscaped area within the facility during the year shall not exceed an amount calculated by multiplying the number of holes present within the facility during the year by 24.0 acre-feet of water per hole, plus any allotment additions allowed under subsection D of this section.*

TABLE 6-1
APPLICATION RATES FOR TURF-RELATED FACILITIES
PINAL ACTIVE MANAGEMENT AREA

From 2002 until the first compliance date for any substitute requirement in the Fourth Management Plan

(Acre-feet per acre per calendar year)

Application Rate - Turf Acres Including Newly Turfed Area

	2002 - Fourth Management Plan
All Facilities	*4.8*

Application Rate - Total Water Surface Area

	2002 - Fourth Management Plan
All Facilities	*6.2*

Application Rate - Low Water Use Landscaped Area

	2002 - Fourth Management Plan
All Facilities	*1.5*

D. Allotment Additions

1. Newly Turfed Area Establishment Addition

For any year in which a warm-season turfgrass species is initially planted at a turf-related facility, the facility shall receive an allotment addition of 1.0 acre-foot of water per acre of newly turfed area. For golf courses, the newly turfed area establishment addition shall not exceed an amount calculated by multiplying the number of holes present within the newly turfed area by 5 acre-feet of water.

2. Revegetation Addition

The owner or operator of a turf-related facility may apply to the director for an allotment addition to revegetate areas within and around the facility after initial construction or renovation of new acres. The director may allow up to an additional 1.5 acre-feet of water per revegetation acre for up to three years if the following conditions apply to the acres for which the revegetation addition is sought:

a. The plants which are planted within the revegetation acres are listed in Appendix 5I, Drought Tolerant/Low Water Use Plant List, or any modifications to the list, or were adapted to the site conditions prior to construction;

b. The aggregate area to be watered exceeds one acre and has at least 50 percent vegetative coverage at maturity;

c. *An allotment is not provided for the revegetation area under subsection A, B, or C of this section; and*

d. *All of the water applied to the revegetation acres is measured and reported as part of the total water use of the facility.*

3. *Body of Water Fill and Refill Addition*

a. *A turf-related facility shall receive a one-time body of water fill allotment addition equal to the volume of water used for the initial filling of any new bodies of water added after January 1, 2002 within the facility. The facility shall receive the allotment addition only for the calendar year in which the body of water is filled.*

b. *If a body of water at a turf-related facility is drained or partially drained to allow for repairs to reduce water losses, the owner or operator of the facility may apply to the director for an addition to the facility's allotment in the amount of water necessary to refill the body of water. The director shall grant the allotment addition if the director determines that draining the body of water was necessary to allow for repairs to reduce water losses. The facility shall receive the allotment addition only for the calendar year in which the body of water is refilled.*

4. *Removed Acreage Addition*

A turf-related facility that removes acres of water-intensive landscaped area in existence within the facility prior to January 1, 1990 shall receive an allotment addition equal to the allotment the acres would have received pursuant to the Third Management Plan if they had not been removed, provided that the acres were given a water allotment in the First Management Plan, the Second Management Plan, or the Third Management Plan.

5. *Leaching Allotment Addition*

The owner or operator of a turf-related facility may apply to the director for an allotment addition for leaching purposes. The director shall approve the application if the water supply used for landscape watering at the facility contains at least 1,000 mg/l of total dissolved solids. If the director approves an allotment addition for leaching purposes, the director shall calculate the additional allotment as follows:

$$\textbf{Leaching Allotment Addition} = \left(\frac{1}{1 - \left(\frac{EC_w}{5EC_e - EC_w} \right)} - 1 \right) \times \frac{CU}{0.85}$$

Where: EC_w = *Electrical conductivity of water used*

EC_e = *Tolerance of the grass species grown to the soil salinity in electrical conductivity of the soil saturation extract*

CU = *Consumptive use requirement for the grass species grown*

Any allotment addition granted under this paragraph shall remain in effect until the water supply used for landscape watering at the facility contains less than 1,000 mg/l of total dissolved solids or until the effective date for the facility's conservation requirements in the Fourth Management Plan, whichever occurs first.

6. *Allotment Addition for Additional Low Water Use Landscaped Area and Turfed Acres Within Post-1985 Turf-Related Facilities that are Regulation Golf Courses*

   a. *The owner or operator of a post-1985 turf-related facility that is a regulation golf course shall receive an allotment addition for additional low water use landscaped area and turf acres if the total low water use landscaped area and turf acres within the facility exceeds an area calculated by multiplying the number of holes within the facility by five acres. The amount of the allotment addition shall be calculated pursuant to subparagraph b of this paragraph and shall be subject to the conditions set forth in subparagraphs c and d of this paragraph.*

   b. *The allotment addition allowed under subparagraph a of this paragraph shall be calculated as follows:*

      1) *Determine the facility's "base allotment acres." The facility's base allotment acres are the total turf acres and low water use landscaped area within the facility, up to a maximum of five acres per hole. In determining the base allotment acres, turf acres shall be counted first.*

      2) *Determine the turf acres and low water use landscaped area within the facility that are not included within the base allotment acres.*

      3) *Multiply the turf acres determined in item 2) above by an application rate of 3.0 acre-feet per acre. Multiply the low water use landscaped area determined in item 2) above by an application rate of 1.5 acre-feet per acre.*

      4) *Add the products in item 3) above. The allotment addition allowed by subparagraph a of this paragraph is the sum of the products in item 3) or an amount calculated by multiplying the number of holes within the facility by five acre-feet, whichever is less.*

   c. *Any allotment addition allowed under subparagraph a of this paragraph shall apply during the seventh through tenth calendar years after the turf-related facility commences landscape watering only if one of the following applies:*

      1) *Direct use effluent or effluent recovered within the area of impact is used within the facility for landscape watering purposes during the year in an amount equal to or greater than the amount of the allotment addition.*

      2) *The owner or operator of the facility extinguishes long-term storage credits earned for the storage of effluent or Central Arizona Project water within the Pinal Active Management Area pursuant to a storage permit issued under title 45, chapter 3.1, Arizona Revised Statutes, in the following amount: a) during the seventh and eighth calendar years after the facility commences landscape watering, the difference between the allotment addition and the amount of direct use effluent or effluent recovered within the area of impact used within the facility for landscape watering purposes during the year; and b) during the ninth and*

tenth calendar years after the facility commences landscape watering, an amount calculated by multiplying 1.5 by the difference between the allotment addition and the amount of direct use effluent or effluent recovered within the area of impact used within the facility for landscape watering purposes during the year. Proof of extinguishment shall be included in the facility's annual water use report required by A.R.S. § 45-632.

d. Any allotment addition allowed under subparagraph a of this paragraph shall apply in any year subsequent to the tenth calendar year after the turf-related facility commences landscape watering only if direct use effluent or effluent recovered within the area of impact is used within the facility for landscape watering purposes during the year in an amount equal to or greater than the amount of the allotment addition.

E. Combined Allotments for Contiguous Facilities

The maximum annual water allotments for contiguous turf-related facilities under one ownership or operation may be combined. All or a portion of the combined maximum water allotment may be applied to any part of the contiguous facilities.

F. *Nothing in this section shall be construed as authorizing the use of more groundwater or surface water than may be used pursuant to any groundwater or appropriable water rights or permits associated with the use. Nor shall this section be construed as authorizing the use of groundwater or surface water in any manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.*

6-304. Compliance with Maximum Annual Water Allotment

A. Effluent Use Adjustment

For purposes of determining compliance with the maximum annual water allotment requirement, the director shall count each acre-foot of direct use effluent or effluent recovered within the area of impact that was used at the turf-related facility for landscape watering purposes during the calendar year as 0.7 acre-foot of water.

B. Flexibility Account

The director shall determine if a turf-related facility is in compliance with the maximum annual water allotment requirement through the maintenance of a flexibility account for the facility according to the following:

1. Beginning with calendar year 2002 or the first full calendar year after the commencement of landscape watering, whichever is later, a flexibility account shall be established for a turf-related facility with a beginning balance of zero acre-feet.

2. Following each calendar year in which groundwater is withdrawn, diverted, or received for landscape watering purposes at the facility, the director shall adjust the turf-related facility's flexibility account as follows:

a. Subtract the total volume of water from any source, including effluent as adjusted under subsection A of this section, used by the facility for landscape watering purposes during that reporting year, from the facility's maximum annual water allotment for that year.

b. If the result in subparagraph a of this paragraph is positive, credit the flexibility account by this volume.

c. If the result in subparagraph a of this paragraph is negative, debit the flexibility account by this volume.

3. The account balance existing in a turf-related facility's flexibility account after the adjustment provided for in paragraph 2 of this subsection is made shall carry forward subject to the following limitations:

a. The maximum positive account balance allowed in the flexibility account of a turf-related facility after any credits are registered pursuant to paragraph 2, subparagraph b of this subsection shall be calculated by multiplying the facility's maximum annual water allotment for the calendar year for which the credits are registered by 0.2. If the account balance exceeds the maximum positive account balance after the credits are registered, the balance carried forward shall be equal to the maximum positive account balance for the calendar year.

b. The maximum negative account balance allowed in the flexibility account of a turf-related facility after any debits are registered pursuant to paragraph 2, subparagraph c of this subsection shall be calculated by multiplying the facility's maximum annual water allotment for the calendar year for which the debits are registered by -0.2. If the account balance is less than the maximum negative account balance after the debits are registered, the balance carried forward shall be equal to the maximum negative account balance for the calendar year.

C. Compliance Status

If the adjustment to a turf-related facility's flexibility account following a calendar year as provided for in subsection B, paragraph 2 of this section, causes the account to have a negative account balance less than the maximum negative account balance allowed in the flexibility account for the calendar year as calculated in subsection B, paragraph 3, subparagraph b of this section, the industrial user who uses water at the facility is in violation of the facility's maximum annual water allotment for that calendar year in an amount equal to the difference between the facility's flexibility account balance and the maximum negative balance allowed in the facility's flexibility account for that year.

6-305. Monitoring and Reporting Requirements

A. *An industrial user who uses water at a turf-related facility that commences landscape watering within any new acres after January 1, 2002 shall submit to the director documentation of the new acreage within the facility no later than 90 days after commencing landscape watering to the new acres or receiving notice of these conservation requirements, whichever is later. The scale of the submitted documents, extent of turf acres, water surface acres, and low water use landscaped area must clearly be shown. Documentation may consist of one or more of the following:*

1. As-built plans certified by a registered professional such a civil engineer, golf course designer, or landscape architect.

2. Aerial photography at a scale no smaller than 1" = 200'.

3. *A survey of the facility certified by a registered professional such a civil engineer or land surveyor.*

4. *Any other documentation upon approval by the director.*

B. *For calendar year 2002 or the calendar year in which landscape watering commences, whichever occurs later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the Fourth Management Plan, an industrial user who uses water at a turf-related facility shall include in the annual report required by A.R.S. § 45-632 the following information:*

1. *The total quantity of water by source, disaggregated by source, withdrawn, diverted, or received during the calendar year for landscape watering purposes at the facility, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

2. *The total amount of effluent, disaggregated by direct use effluent, effluent recovered within the area of impact, and effluent recovered outside the area of impact that was withdrawn or received during the calendar year for landscape watering purposes at the facility, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

3. *The number of acres of turf acres within the facility during the calendar year, not including newly turfed area.*

4. *The number of acres of total water surface area within the facility during the calendar year.*

5. *The number of acres of low water use landscaped area within the facility during the calendar year.*

6. *The number of acres of newly turfed area within the facility during the calendar year.*

7. *The number of turf acres removed within the facility during the calendar year.*

8. *The number of acres of total water surface area added or removed within the facility during the calendar year.*

9. *The number of acres of low water use landscaped area added or removed within the facility during the calendar year.*

10. *If the facility is a golf course, the length of the course as measured from the back of each tee ground furthest from the associated green, then down the center line of the hole to the center of the green.*

11. *The number of acres approved by the director for a revegetation addition pursuant to section 6-303, subsection D, paragraph 2, within the facility during the calendar year.*

12. *The quantity of water used to fill or refill a body of water within the facility during the calendar year, for which an allotment addition is sought pursuant to section 6-303, subsection D, paragraph 3.*

13. *The number of acres of overseeded area within the facility during the calendar year.*

14. *If the facility is a golf course, the number of holes within the facility during the calendar year.*

15. *If the facility is a golf course, the number of holes added during the calendar year.*

16. *If the facility is a golf course that qualifies as a pre-1986 turf-related facility, the number of acres of turf acres, low water use landscape area and water surface acres added to the facility after December 31, 1985, and the number of holes added to the facility after December 31, 1985.*

17. *An estimate of the quantity of water from any source, including effluent, used for each purpose other than landscape watering purposes at the facility during the reporting year. Any water used at the facility that is not measured separately from the water used for landscape watering shall be counted by the director as water used by the facility for landscape watering for purposes of calculating the compliance with the maximum annual water allotment.*

C. *A single annual report may be filed for contiguous turf-related facilities if the maximum annual water allotments of the facilities are combined pursuant to section 6-303, subsection E. The annual report shall report water use and landscaped areas of the contiguous facilities as required in subsection B of this section.*

6.4 SAND AND GRAVEL FACILITIES

6.4.1 Introduction

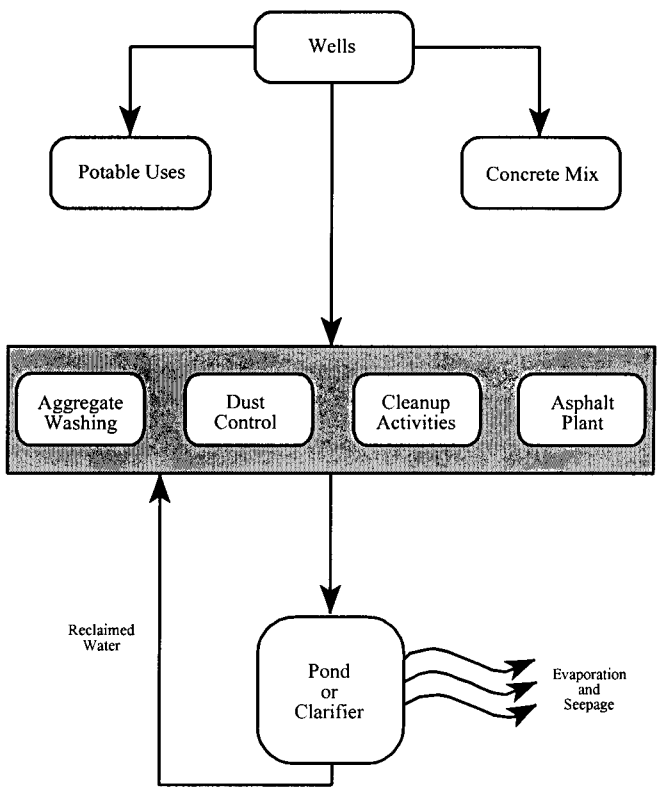
Sand and gravel facilities regulated under the Third Management Plan are those facilities that produce sand and gravel and use more than 100 acre-feet of water, from any source, in a calendar year. Sand and gravel facilities may mine aggregate, mix concrete, and produce asphaltic concrete.

6.4.2 Water Use by Sand and Gravel Facilities

In the Pinal AMA, there are six sand and gravel facilities, which hold Type 2 grandfathered rights and groundwater withdrawal permits totaling 3,491 acre-feet. In 1995, sand and gravel facilities in the AMA withdrew only 253 acre-feet of groundwater, or just greater than 7 percent of their total annual allotments. Since the beginning of the second management period, all water use in this subsector has come from just two facilities. It is projected that sand and gravel water use will grow commensurate with economic development in the AMA, reaching about 700 acre-feet by the year 2025.

Sand and gravel facilities mine unconsolidated streambed deposits to produce construction materials. The aggregate is sorted according to grain size and washed to remove fine-grained particles. Aggregate washing accounts for the bulk of water use by sand and gravel facilities. In addition to using water for washing, water is used for the following purposes: (1) to produce ready-mix concrete, bricks, blocks, and asphaltic concrete; (2) to control dust; (3) to wash the outside of vehicles; (4) to wash the inside of mixer drums; (5) to wash other equipment; (6) to cool equipment; (7) to cool material; and (8) for domestic purposes. Figure 6-1 illustrates how water is cycled in a typical sand and gravel facility.

FIGURE 6-1
DIAGRAM OF WATER FLOW IN A TYPICAL SAND AND GRAVEL FACILITY



Most sand and gravel facilities recycle wash water using excavated pits called disposal ponds. Sediment-laden wash water is pumped or diverted into a pit or series of pits where sediment is allowed to settle out. After this sediment settles out, the water is recycled to the plant and used to wash more material. Water can also be pumped from the pond for dust control, truck washing, or other cleanup activities.

Geologic and hydrologic conditions at some facilities may result in a large amount of seepage loss incidentally returning to the aquifer from disposal ponds, resulting in the incidental recharge of the aquifer. Because many facilities are located along riverbeds, depth to groundwater can be relatively shallow. Some sand and gravel facilities may need to dewater to lower the water table in order to excavate. Water lost to seepage may become a component of the groundwater pumped by sand and gravel facilities.

An alternative method of recycling wash water is the use of clarifiers. A clarifier is a device that accelerates the settling of sediment without creating the need for a large disposal pond. Chemical flocculants are usually used in conjunction with clarifiers to further enhance the removal of solid particles from the wash water.

Recycled water is not used for mixing concrete because the use of recycled water in the mixture may result in a product of inferior strength and quality. However, aggregate used in the concrete can be washed with recycled water without affecting concrete strength.

The ability of sand and gravel facilities to save water varies because of differences in geology, availability and cost of land and water, product demand and price, and other factors. It may therefore be economically feasible to use the latest commercially available conservation technology at some facilities but not at others.

Because recycled water can be used for most purposes at a sand and gravel facility, the maximum savings of water can occur in the recycling of wash water from aggregate washing and, to a lesser extent, the recycling of water used for wet scrubbers at asphalt plants.

There are a number of conservation techniques that may be employed to reduce the amount of water used to control dust raised by trucks traveling on haul roads. Binding agents, pavement, or other surface treatments may be used. Water uses for cleanup activities may be made more efficient by metering truck washing and by using alternative methods to clean truck mixer drums, such as the "rock out" method, which means agitating rock inside the mixer drums for the purpose of cleaning excess concrete, or chemical set-arresting agents, which prevent excess concrete from adhering to the mixer drums.

Sand and gravel facilities that have asphalt plants may have air emissions from the plant cleaned by either baghouses or wet scrubbers. Of these two methods, baghouses do not require water.

6.4.3 Program Development and Issues

A requirement to recycle wash water using disposal ponds or clarifiers was set forth in the First Management Plan. This requirement ensures that sand and gravel facilities reduce their primary water use. The First Management Plan requirements were carried over into the second management period.

In order to identify the most economical conservation methods for each facility, sand and gravel facility managers were required during the second management period to evaluate specific water-saving methods and submit a conservation plan to the Department.

Besides the conservation requirements identified in the First and Second Management Plans, there are a number of economical ways water use could be reduced for dust control and cleanup activities. However, because conditions and characteristics at each facility vary, flexibility is needed to allow facility managers to select the requirements most appropriate for their facility.

6.4.4 Sand and Gravel Conservation Program

The First and Second Management Plan requirements to recycle wash water are carried over into the third management period because they improve water use efficiency and can be applied at all sand and gravel facilities.

Sand and gravel facility managers can achieve the greatest water savings by applying the most appropriate conservation methods for their facility. In addition to recycling wash water, sand and gravel facilities will choose two additional requirements, one of which is related to water used for dust control, the other of

which is related to cleanup activities or disposal pond surface area reduction, that are most appropriate for their facility for the third management period.

Similar to the Second Management Plan, sand and gravel facility managers are required under the Third Management Plan to evaluate specific water-saving methods and submit a conservation plan to the Department. The plan for improving water use efficiency during the third management period must be submitted to the director by January 1, 2002 or within 180 days after notification of the conservation requirements, whichever is later.

The implementation of some water conservation practices or technologies can result in increased profits. Sand and gravel facility managers should analyze conservation methods to identify those that will result in a positive economic return. Operators will be required to perform an economic analysis of three potential conservation practices: disposal pond surface area reduction, use of clarifiers, and the use of alternative water supplies. The following potential costs and savings should be calculated in the economic analysis:

- Labor (including planning, construction, operation, maintenance, and management time);
- Equipment (values amortized over the projected life of the equipment);
- Land value (including value of mineral reserves);
- Water costs (including pumping costs, well maintenance, and withdrawal taxes);
- Chemicals and raw materials;
- Fuel or energy costs;
- Sewage disposal costs;
- Changes in revenue caused by changing production rate, minimizing "down-time," or increasing the size of reserves; and
- Regulatory permitting costs.

6.4.5 Future Directions

As previously mentioned, sand and gravel facilities in the Pinal AMA are supplied by non-irrigation grandfathered rights or groundwater withdrawal permits. Other potential water sources include CAP water and effluent. These supplies, however, are not currently being used by sand and gravel facilities in the AMA because neither CAP water nor effluent are readily available to them. Even if CAP water were available, it costs significantly more to purchase than the cost of pumping groundwater. Pumping costs are usually low for sand and gravel facilities, which are located adjacent to rivers where groundwater levels are close to the surface. In the future, alternatives to groundwater pumping may be viable options for most water uses at sand and gravel facilities and, if so, could be addressed during subsequent management periods.

6.4.6 Industrial Conservation Requirements and Monitoring and Reporting Requirements for Sand and Gravel Facilities

6-401. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases used in sections 6-402 through 6-404 of this chapter shall have the following meanings:

1. *"Alternative water supply" means a water source other than groundwater of drinking water quality.*

2. *"Sand and gravel facility" means a facility that produces sand and gravel and that uses more than 100 acre-feet of water from any source per calendar year. For purposes of this definition, the annual water use shall include all water used by the facility regardless of the nature of the use.*

3. *"Rock out method" means agitating rock inside concrete truck mixer drums for the purpose of cleaning excess concrete from the drums.*

4. *"Wash water" means water used for washing or sorting sand, gravel, or other aggregates.*

6-402. Conservation Requirements

A. Standard Conservation Requirements

Beginning on January 1, 2002 or upon commencement of water use, whichever occurs later, and continuing thereafter until the first compliance date for any substitute conservation requirements in the Fourth Management Plan, an industrial user who uses water at a sand and gravel facility shall comply with the following conservation requirements:

1. *If sufficient land area for construction and operation of disposal ponds is available at a reasonable price, the industrial user shall construct disposal ponds at the sand and gravel facility. All wash water, all water used for wet scrubbers at asphalt plants, all runoff from cleanup operations and all drainage from sand and gravel piles shall be discharged or diverted into the disposal ponds unless prohibited by state or federal environmental regulations. The disposal ponds shall contain a barge pump or sump pump of sufficient capacity, together with any necessary additional equipment, to assure the maximum reclamation of the water. The water shall be reclaimed and reused at the sand and gravel facility unless prohibited by state or federal regulations.*

2. *If sufficient land area for the construction and operation of disposal ponds is not available at a reasonable price, clarifiers shall be used at the sand and gravel facility for reclaiming wash water, all water used for wet scrubbers at asphalt plants, runoff from cleanup operations and all drainage from sand and gravel piles. The clarifiers shall be designed and operated to assure the maximum reclamation of water. The water shall be reclaimed and reused at the sand and gravel facility unless prohibited by state or federal regulations.*

3. *At least one of the following techniques or technologies designed to reduce water use for dust control shall be implemented at the sand and gravel facility:*

   a. *The placement of binding agents on all haul roads;*

   b. *The paving of all haul roads;*

   c. *The placement of recycled asphalt on all haul roads;*

   d. *The placement of medium sized aggregate or "pea gravel" on all haul roads; or*

   e. *A technology or technique designed to reduce water use for dust control not included in subparagraphs a through d of this paragraph that demonstrates water savings equivalent to any of the technologies or techniques listed in subparagraphs a through d, and that has been approved by the director.*

   The industrial user shall have sole discretion in determining whether to implement more than one of the above technologies.

4. *At least one of the following techniques or technologies designed to reduce water use for cleaning shall be implemented at the sand and gravel facility:*

   a. *Use of metered timers for truck washing and other cleanup activities;*

   b. *Use of the "rock out method" of cleaning concrete from truck mixer drums;*

   c. *Use of concrete set-arresting agent chemical applications to clean concrete from truck mixer drums; or*

   d. *A technology or technique designed to reduce water use for cleaning that is not included in subparagraphs a through c of this paragraph that demonstrates water savings equivalent to any of the measures listed in subparagraphs a through c and that has been approved by the director.*

   The industrial user shall have sole discretion in determining whether to implement more than one of the above technologies.

B. Substitute Conservation Requirements

1. *An industrial user who uses water at a sand and gravel facility may apply to the director to use conservation technologies other than the standard conservation requirements prescribed in subsection A of this section. The director may approve the use of substitute conservation technologies if both of the following apply:*

   a. *The industrial user has submitted a detailed description of the proposed substitute technologies and the water savings that can be achieved by the use of those technologies; and*

   b. *The director determines that the proposed substitute conservation technologies will result in a water savings equal to or greater than the savings that would be achieved by the standard conservation requirements prescribed in section 6-402.*

2. *If the director approves an industrial user's request to use conservation technologies other than the standard conservation requirements prescribed in subsection A of this section, the industrial user shall comply with the substitute conservation technologies approved by the director beginning on the date determined by the director and continuing until the first compliance date for any substitute conservation requirement in the Fourth Management Plan.*

C. Conservation Plan

Not later than January 1, 2002 or within 180 days after receiving notice of these conservation requirements, whichever is later, an industrial user who uses water at a sand and gravel facility, including an industrial user who acquires ownership of an existing sand and gravel facility after January 1, 2002, shall submit to the director a plan to improve the efficiency of water use at the facility on a form provided by the director. The plan shall analyze the economic feasibility of implementing all of the following techniques at the facility:

1. *Disposal pond surface area reduction.*

2. *The use of clarifiers for recycling water.*

3. *Use of an alternative water supply if such a supply is available within a one mile radius of the facility.*

6-403. Monitoring and Reporting Requirements

For calendar year 2002 or the calendar year in which the sand and gravel facility first commences using water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the Fourth Management Plan, an industrial user who uses water at a sand and gravel facility shall include the following information in its annual report required by A.R.S. § 45-632:

1. *The quantity of water reclaimed from disposal ponds or clarifiers during the calendar year, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

2. *The quantity of water from any source, including effluent, supplied to the wash plant during the calendar year, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

3. *The quantity of water from any source, including effluent, supplied to the asphalt plant during the calendar year, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

4. *The aggregate surface area of any disposal ponds.*

5. *The average depth of any disposal ponds.*

6. *The estimated quantity of water from any source, including effluent, used during the calendar year for:*

a. *Industrial process purposes. Water used for industrial process purposes includes water used for sanitary waste disposal but does not include water used for cooling and cleaning purposes.*

b. *Non-domestic cooling purposes.*

c. *Non-domestic cleaning purposes. Water use for non-domestic purposes includes truck washing, truck mixer drum washing, or other non-domestic cleaning purposes.*

d. *Road dust control.*

e. *Landscape watering.*

f. *Other purposes.*

7. *The tonnage of material washed during the calendar year.*

6.5 METAL MINING FACILITIES

6.5.1 Introduction

The mining of copper has been the primary concern of metal mining facilities in the Pinal AMA. Historically, the methods that have been used to mine copper have been open pit and underground. Due to the depth and grade of ore bodies located in the AMA, this process is no longer commercially feasible. Consequently, mining companies in the AMA are now using an innovative process known as "in situ"or "in-place" mining. This process requires only a fraction of the water needs as compared to conventional mining techniques.

6.5.2 Water Use by Metal Mining Facilities

Currently, metal mining facilities have rights to pump over 8,500 acre-feet per year of groundwater pursuant to Type 1 and Type 2 grandfathered rights and groundwater withdrawal permits. Withdrawals can vary substantially from year to year due to fluctuations in copper market conditions.

Historical water use for metal mining facilities within the AMA has been low, usually constituting the smallest industrial water use subsector. In 1995, just 29.4 acre-feet were used by metal mining facilities.

The two mining companies that currently operate within the Pinal AMA hold multiple water rights. ASARCO has two different facilities: the Santa Cruz Joint Venture, which is an operational research facility for in situ mining; and the Sacaton Unit, which has been closed since the early 1980s. Additionally, ASARCO operates the Silver Bell Mine, which straddles the boundary of the Pinal and Tucson AMAs. Because the mine's production wells are located within the Tucson AMA, water use at the facility is regulated by that AMA. The new BHP (formerly Magma Copper) mine near Florence, which will utilize in situ methods on a commercial basis, is expected to be fully operational during the third management period.

6.5.3 Program Development and Issues

First Management Plan requirements for metal mining facilities largely reflected mining practices in place at the time the regulations were written. Key requirements for metal mining facilities included:

- Transport tailings at a minimum average density of 40 percent solids by weight
- Reduce leakage from tailings impoundments by compacting tailings up-slope from the free water surface in ponds or by installing interceptor wells
- Manage tailings impoundments to minimize free water surface, maximize water depth, create stilling basins, and recover decant water
- Recover and recycle tailings impoundment water
- Cap abandoned tailings impoundments to minimize water used for dust control
- Comply with monitoring and reporting requirements

The First Management Plan also required that metal mining facilities built after 1985 were to achieve the greatest feasible tailings density, install any new wells so they would intercept tailings seepage, and equip any new tailings facilities with decant towers and interceptor wells to reclaim tailings pond water and intercept seepage. In the First Management Plan, metal mining facilities could apply for alternative conservation programs or temporary stays from conservation requirements.

First Management Plan requirements were modified in the Second Management Plan to require tailings densities of 45 percent for existing metal mining facilities and 50 percent for new facilities. In addition, all facilities were required to prepare long-range conservation plans in which they were to evaluate the

feasibility of using alternative water sources, reducing tailings evaporation, minimizing water use for dust control, and increasing tailings density to 55 percent.

6.5.4 Metal Mining Conservation Program

While there are currently no facilities within the Pinal AMA engaged in open-pit mining, this mining process is still common within the state. In the event that open-pit or underground mining methods are employed during the third management period, the legal requirements are included within this subsection. (For more information regarding program description of the traditional mining process, refer to the Tucson AMA's Third Management Plan.)

Because in situ mining is the only metal mining process used within the Pinal AMA, the Third Management Plan requirements include the following provisions:

- Long-range conservation plan
- Minimize water use to the extent practicable
- Comply with monitoring and reporting requirements

During the third management period, metal mines will be required to evaluate water conservation practices and technologies that may be implemented at their facility and submit these to the Department in a long-range conservation plan. Conservation plan requirements for new facilities have shifted emphasis from providing site evaluation data to analyzing the latest available conservation technologies consistent with reasonable economic return.

A provision has been added in the Third Management Plan to address possible overlaps or conflicts between water conservation requirements and other environmental regulations. In determining compliance with mine conservation requirements, the director must ensure this compliance does not result in the mines violating other local, state, or federal environmental regulations. Environmental regulations may include Best Available Demonstrated Control Technologies specified by the ADEQ in their mine Aquifer Protection Permit (APP) requirements, mine closure requirements specified in APPs, mine closure requirements specified in the Mine Reclamation Act, air quality standards, federal Clean Water Act provisions, and others.

6.5.5 Industrial Conservation Requirements and Monitoring and Reporting Requirements for Metal Mining Facilities

6-501. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases shall have the following meanings:

1. *"Abandoned tailings impoundment" means a tailings impoundment that the owner/operator of a metal mining facility does not plan to use for additional disposal of tailings.*

2. *"Alternative water supply" means a water source other than groundwater of drinking water quality.*

3. *"Decant water" means water removed from the stilling basin of a tailings impoundment either by gravity flow into a decant tower or by pumping.*

4. *"Heap and dump leaching" means the extraction of minerals using acid solutions applied to metallic ores which have been removed from their original location and heaped or dumped in a new location.*

5. *"In situ leaching" means the extraction of metallic ores using acid leaching of ores which are not moved from their original natural location.*

6. *"In situ leaching sites" mean those portions of metal mining facilities at which in situ leaching and associated copper recovery operations occur, including surface applications of acid leaching solutions and deep well injection of acid leaching solutions.*

7. *"Large-scale metal mining and processing facility" means an industrial facility at which mining and processing of metallic ores is conducted and which uses or has the potential to use more than 500 acre-feet of water per reporting year. For the purposes of this definition, the annual water use or potential annual water use includes all water from any source, including effluent, used or projected to be used within or by the facility, regardless of the nature of the use.*

8. *"Mill concentrator" means the structure at open-pit metal mines within which metallic ore is crushed and the flotation process is used to remove minerals.*

9. *"Mill circuit" means the flow of water used in the process of crushing ore, recovering copper at the mill concentrator, and transporting and disposing of tailings, and includes recovery of water at the tailings impoundments for reuse in the mill concentrator.*

10. *"Post-1985 metal mining facility" means either:*

    a. *A large-scale metal mining and processing facility that does not qualify as a pre-1986 metal mining facility, including any expanded or modified portion of the facility; or*

    b. *Any expanded or modified portion of a pre-1986 metal mining facility if the expansion or modification includes one or more new tailings impoundments, new mill circuits,*

or new leaching facilities, and was not substantially commenced as of December 31, 1985.

11. *"Pre-1986 metal mining facility" means a large-scale metal mining and processing facility at which the mining and processing of metallic ores was occurring as of December 31, 1985 or which was substantially commenced as of December 31, 1985 and includes any expanded or modified portion of such a facility if the expansion or modification includes one or more new tailings impoundments, new mill concentrator circuits, or new wells and was substantially commenced as of December 31, 1985.*

12. *"Seepage water" means water which has infiltrated from tailings impoundments into the material underlying the tailings impoundments.*

13. *"Substantially commenced as of December 31, 1985" means, with regard to the construction, expansion, or modification of a large-scale metal mining and processing facility, that the owner or operator of the facility had obtained all pre-construction permits and approvals required by federal, state, or local governments for the construction, expansion, or modification of the facility by December 31, 1985 or had made a substantial capital investment in the physical on-site construction of the project in the 12 months prior to December 31, 1985.*

14. *"Tailings" mean the slurry of water and fine-grained waste rock material remaining after minerals have been removed in the mill concentrator and excess water has been recovered and returned to the mill concentrator.*

15. *"Tailings impoundment" means the final disposal site for tailings generated in the milling circuit.*

6-502. Conservation Requirements for Pre-1986 Metal Mining Facilities

Beginning on January 1, 2002 and continuing thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management Plan, an industrial user who uses water at a pre-1986 metal mining facility shall comply with the following requirements:

A. Management of Tailings Density

The industrial user shall transport tailings to the tailings impoundment area at the maximum density possible consistent with reasonable economic return; but, beginning with calender year 2002, the average density of the tailings during transport shall be 48 percent solids by weight or greater during the period consisting of the reporting year and the previous two years. The director may reduce the density required for a period of time determined by the director if the industrial user demonstrates that due to the shut down of ore processing or tailings transport equipment or due to the density of ore being mined a three-year average density of 48 percent or greater cannot be achieved.

B. Management of Presliming/Interceptor Wells

The industrial user shall comply with one of the following:

1. *Deposit a layer of tailings immediately up-slope from the free water level in each tailings impoundment. The tailings layer shall be 12 inches or more in thickness and shall minimize soil surface permeability.*

2. *Drill interceptor wells down-gradient from each tailings impoundment. The interceptor wells shall be designed, located, and operated in such a manner as to intercept the maximum amount of seepage water possible from each tailings impoundment. Water recovered from the interceptor wells shall be reused at the mining facility.*

C. Management of Water in Tailings Impoundments

The industrial user shall minimize the free water surface area in each tailings impoundment by complying with all of the following:

1. *Manipulate tailings which have been disposed of in a tailings impoundment and manage new disposal of tailings in an impoundment to create stilling basins that increase the rate of recovery of decant water from the stilling basins and to minimize the free water surface area of stilling basins.*

2. *Use decant towers, barge pumps, or sump pumps to recycle water from each tailings impoundment back to the mill concentrator.*

3. *Expand decant tower barge pumping capacity where necessary to increase the capacity to recycle water from each tailings impoundment back to the mill concentrator.*

4. *Use, to the maximum extent possible, tailings impoundment water rather than pumping additional groundwater.*

D. Capping Abandoned Tailings Impoundments

The industrial user shall cap each abandoned tailings impoundment in a manner which minimizes the quantity of water used for dust control purposes and/or revegetation.

E. Heap and Dump Leaching

The industrial user shall apply water to heap and dump leaching operations in a manner which minimizes water use to the extent practicable, consistent with reasonable economic return.

F. Additional Conservation Measures

An industrial user who uses water at a metal mining facility shall comply with three of the following eight conservation measures at those portions of the facility that do not qualify as in situ leaching sites:

1. *When revegetating abandoned mine-related areas, utilize drought-tolerant vegetation.*

2. *Utilize multiple decant towers in single impoundments to increase decant rate.*

3. *Convert piping to high density polyethylene piping to increase density of transported tailings.*

4. *Harvest and reuse storm water runoff on site.*

5. *Reuse pit dewatering water.*

6. *Reduce evaporation from free-standing water surfaces in addition to evaporation reduction from stilling basins.*

7. *Reduce water used for dust control by reducing the number and extent of haul trips, using road binders, converting to conveyors for material transport, or using another dust control measure which reduces water use.*

8. *Reduce water used for delivery of acid/water solution for heap or dump leaching operations by using delivery methods that use less water than sprinkler delivery.*

6-503. Conservation Requirements for Post-1985 Metal Mining Facilities

Beginning on January 1, 2002 or upon commencement of operations at the facility, whichever is later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management Plan, an industrial user who uses water at a post-1985 metal mining facility shall comply with conservation requirements applicable to pre-1986 metal mining facilities as prescribed in section 6-502, subsections C through F, and the following additional requirements:

A. Management of Tailings Impoundments

The industrial user shall design and construct any post-1985 tailings impoundments to maximize recovery of water from the stilling basins and to minimize seepage water. Any interceptor wells down gradient of tailings impoundments shall be constructed to maximize recovery of seepage water.

B. Management of Tailings Density

The industrial user shall design, construct, and operate any post-1985 mill concentrators and their associated tailings transport systems to achieve the maximum tailings densities possible consistent with reasonable economic return, but the average annual density of tailings during transport shall not be less than 50 percent solids by weight.

C. Management of In Situ Leaching

The industrial user shall utilize water for in situ leaching in a manner which minimizes water use to the extent practicable, consistent with reasonable economic return.

6-504. Alternative Conservation Program

An industrial user who uses water at a metal mining facility may apply to the director to use conservation technologies other than the technologies prescribed in sections 6-502 and 6-503, whichever is applicable. The director may approve the use of alternative conservation technologies if the director determines that both of the following apply:

1. *The industrial user has filed a detailed description of the proposed alternative technologies and the water savings that can be achieved by the use of these technologies with the director.*

2. *The industrial user has demonstrated to the satisfaction of the director that the latest commercially available conservation technology consistent with reasonable economic return will be used.*

6-505. Modification of Conservation Requirements for Metal Mining Facilities

A. *An industrial user who uses water at a metal mining facility may apply to the director to modify conservation requirements prescribed in sections 6-502 and 6-503, whichever is applicable, for any year in which compliance with the conservation requirements would likely result in violation of any federal, state, or local environmental standards or regulations. To apply for a modification of conservation requirements, an industrial user shall submit a request in writing to the director which includes the following information:*

1. *Documentation describing the conservation requirement(s) for which compliance with this requirement is likely to result in violation of environmental standards and the environmental standards which are likely to be violated.*

2. *The proposed modification to the conservation requirements.*

B. *The director shall grant a request for modification of conservation requirements if the director determines that compliance with the conservation requirements prescribed in sections 6-502 and 6-503, whichever is applicable, would likely result in a violation of any federal, state, or local environmental standards or regulations.*

6-506. Preparation of a Long-Range Conservation Plan for Metal Mining Facilities

By January 1, 2002 or three months prior to commencement of operations at the facility, whichever is later, an industrial user who uses water at a metal mining facility shall submit to the director a long-range water conservation plan which describes the existing or planned design, construction, and operation of the facility, including a description of the ore type, method of mining, and method of metal extraction. The plan shall include an evaluation of the use of the latest commercially available conservation technology consistent with reasonable economic return. Prior to submitting the plan, the industrial user shall analyze the feasibility of applying the following conservation practices or technologies at the mine and shall report the results in the plan:

1. *Using alternative water sources for mining and metallurgical needs, including determining the source and volume of the alternative water sources being analyzed.*

2. *Reducing tailings impoundment evaporation through the application of the latest commercially available technologies for minimizing evaporation from the impoundments and through the application of improved tailings management.*

3. *Minimizing water use for dust suppression through the use of road binders, conveyors, paved haul roads, and other available dust control mechanisms.*

4. *Increasing tailings densities to 55 percent solids or greater by weight.*

The industrial user may include any additional conservation techniques or technologies in the plan. The plan shall include a schedule of the approximate dates for implementation of any conservation practices or technologies which the industrial user intends to implement.

6-507. Monitoring and Reporting Requirements for Metal Mining Facilities

A. Water Measurement and Reporting

For calendar year 2002 or the calendar year in which the facility commences operation, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Fourth Management Plan, an industrial user who uses water at a metal mining facility shall include in its annual report required by A.R.S. § 45-632 the following information:

1. *The quantity of water from any source, including effluent, used during the calendar year for each of the following purposes: dust control, tailings revegetation, domestic use, and transportation of tailings to tailings impoundments. The quantity of water used for dust control and tailings revegetation shall be separately measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq. The quantity of water used for domestic use and transportation of tailings to tailings impoundments may be estimated.*

2. *The quantity of make-up water from any source, including effluent, used during the calender year for each of the following purposes: equipment washing, leaching operations, and milling operations, as separately measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

3. *The quantity of water from any source, including effluent, reclaimed during the calendar year from each of the following: tailings impoundments and pit dewatering. These quantities shall be separately measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R-12-15-901, et seq.*

4. *The tons of ore milled during the calendar year.*

5. *The tons of ore stacked to heap and/or dump leach during the calendar year.*

6. *The tons of ore vat leached during the calendar year.*

7. *The tons of material mined during the calendar year.*

8. *The tons of mineral produced from mill circuits and from leach circuits during the calendar year.*

9. *The average gallons of water consumed per ton of mineral produced during the calendar year.*

10. *The average percentage of solids by weight in tailings transported to the tailings impoundments during the calendar year and in each of the previous two years.*

11. *The average annual depth of water at the deepest portion of the stilling basin(s).*

12. *Copies of aerial photos of tailings impoundments, with scale indicated, for use by the Department in determining the wetted surface area of the tailings impoundments.*

13. *A description of the additional conservation measures applied at the metal mining facility as prescribed in section 6-502, subsection F.*

B. Contiguous Facilities

A single annual report may be filed for a pre-1986 metal mining facility and a post-1985 metal mining facility which are contiguous and owned by the same owner. The combined operations of the metal mining facilities shall be described pursuant to reporting requirements specified in subsection A of this section.

6.6 LARGE-SCALE POWER PLANTS

6.6.1 Introduction

The Department regulates power plants that produce or are designed to produce more than 25 megawatts of electricity. The electric power industry uses cooling towers to dissipate excess heat that builds up in the electrical generation process. Evaporation losses in the cooling towers at power plants are the major consumptive use of water at these facilities. Because of the large volume of water used in this capacity, conservation requirements for the electric power industry require facilities to achieve a high level of efficiency in cooling tower operations.

6.6.2 Water Use by Large-Scale Power Plants

Although there are currently no large-scale power plants in the Pinal AMA, it is anticipated that one will be constructed in Casa Grande in the near future. The proposed facility will be powered by natural gas and produce up to 500 megawatts of electricity. The facility's annual water demand is expected to be nearly 4,000 acre-feet. Initially, most of this demand is expected to be met through the use of municipal CAP water allocated to the Arizona Water Company's Casa Grande system. Effluent from the City of Casa Grande's wastewater treatment plant will also be used. As the city grows and the supply of effluent increases, it is anticipated that more effluent and less CAP water will be used.

Most electric power plants have two water use circuits, referred to here as the generating circuit and cooling circuit. In the generating circuit, water is heated in the boiler to form steam that turns the turbines. The turbines in turn drive the generators that create electricity. The steam must be cooled and condensed into water before being recycled back to the boiler. The conversion of water to steam and back to water in the generating circuit is completed in a closed system, so water is efficiently recycled with little loss.

At the condenser, heat is transferred from the steam in the generating circuit to the cooled water in the cooling circuit. Because this heat exchange occurs through the walls of the condenser piping, water in the two circuits does not mix. The heated water in the cooling circuit is pumped to a cooling tower where it is cooled by evaporation. The cooled water is then recirculated back to the condenser. Evaporation losses in the cooling tower constitute the main consumptive use of water at electric power plants. As a portion of the cooling circuit water evaporates in the cooling tower, dissolved minerals become more concentrated in the remaining water. Due to the high mineral concentrations, corrosion, mineral deposition, and biological fouling can result and may lead to reduced cooling efficiency and equipment damage. Use of chemical treatments can prolong water use in a tower; but periodically, mineral-laden water must be discharged or "blown down" to prevent minerals from precipitating on equipment. Replacement water, known as "make-up water," is added to replace water lost to evaporation and blowdown.

The "cycles of concentration" or "concentration ratio" achieved in a tower indicate how efficiently water is being used. Cooling towers that are consistently operated at higher cycles of concentration consume less water than towers consistently operated at lower cycles of concentration. Cycles of concentration can be determined by dividing the concentration of a constituent in the blowdown water by the concentration of this same constituent in the make-up water. Total dissolved solids content is one commonly used constituent for calculating the cycles of concentration.

6.6.3 Large-Scale Power Plant Program

The Third Management Plan requires that large-scale power plants achieve an annual average of 15 cycles of concentration in their cooling towers. The cycles of concentration requirement applies only during periods when facilities are generating electricity and applies only to fully operational towers that are dissipating heat from the power generation process. In addition to achieving 15 cycles of concentration,

facilities must discharge blowdown water and add make-up water to cooling towers on a continuous basis and divert the maximum possible volume of onsite wastewater (other than blowdown water and sanitary wastewater) to the cooling process.

Facilities may be granted adjustments to their full cycles of concentration requirements in cases where, due to the quality of recirculating water, adhering to the 15 cycles of concentration standard is likely to result in equipment damage or blowdown water exceeding environmental discharge standards. Cooling towers at power plants are exempted from cycles of concentration requirements during the first 12 months in which treated effluent constitutes more than 50 percent of tower water supply. After this period, facilities may request an adjustment to full cycles of concentration requirements for effluent-served towers based on the water quality of the treated effluent supply.

Facilities may apply to the director to use alternative conservation technologies in place of achieving 15 cycles of concentration if the use of the proposed alternative technologies will result in equal or greater water savings. Facilities may also request a waiver from conservation requirements on the basis that cooling tower blowdown water is completely reused. Facilities must periodically measure and annually report blowdown water volumes, make-up water volumes, and the chemical concentration of blowdown and make-up water. In addition, facilities must report the amount of electricity generated, periods when they are not generating electricity, and the volume of water used for purposes other than electric power generation.

6.6.4 Future Directions

As previously mentioned, there are currently no large-scale power plants in the Pinal AMA. The facility that is currently being planned for the Casa Grande area is expected to utilize 100 percent renewable supplies.

6.6.5 Industrial Conservation Requirements and Monitoring and Reporting Requirements for Large-Scale Power Plants

6-601. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases shall have the following meanings:

1. *"Blowdown water" means water discharged from a cooling tower recirculating water stream to control the buildup of minerals or other impurities in the recirculating water.*

2. *"Conservative mineral constituent" means a component of recirculating water in a cooling tower, the concentration of which is not significantly modified by precipitation, loss to the atmosphere, or the addition of treatment chemicals.*

3. *"Continuous blowdown and make-up" means patterns in cooling tower operation which include continuous blowdown and make-up or frequent periodic blowdown and make-up of recirculating water.*

4. *"Cycles of concentration" means the ratio of the concentration of total dissolved solids, other conservative mineral constituent, or electrical conductivity in the blowdown water to the concentration of this same constituent or electrical conductivity in the make-up water.*

5. *"Effluent-served cooling tower" means a cooling tower served by a make-up water supply which on an annual average basis consists of 50 percent or more effluent.*

6. *"Fully operational cooling tower" means a cooling tower that is functioning to dissipate heat from a large-scale power plant that is generating electricity.*

7. *"Large-scale power plant" means an industrial facility that produces or is designed to produce more than 25 megawatts of electricity.*

8. *"Limiting Constituent" means a chemical, physical, or biological constituent present in recirculating cooling tower water which, due to potential physical or biological factors or due to potential exceedence of any federal, state, or local environmental standards upon discharge as blowdown, should not be allowed to accumulate in recirculating cooling tower water above a certain concentration.*

9. *"Make-up water" means the water added back into the cooling tower recirculating water stream to replace water lost to evaporation, blowdown, or other mechanisms of water loss.*

6-602. Conservation Requirements for Large-Scale Power Plants

Beginning on January 1, 2002 or upon commencement of water use, whichever occurs later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management Plan, an industrial user who uses water at a post-1984 power plant shall comply with the following requirements:

1. *An annual average of 15 or more cycles of concentration shall be achieved at fully operational cooling towers during periods when the power plant is generating electricity.*

2. *Blowdown water shall be discharged on a continuous basis, and make-up water shall be provided on a continuous basis.*

3. *The maximum amount of wastewater feasible, excluding blowdown water and sanitary wastewater, shall be diverted to the cooling process.*

6-603. Cycles of Concentration Adjustment Due to the Quality of Recirculating Water

A. *An industrial user who uses water at a large-scale power plant may apply to the director for an adjustment to the cycles of concentration requirements set forth in section 6-602 if compliance with the cycles of concentration requirements would likely result in damage to cooling towers or associated equipment or exceedence of federal, state, or local environmental discharge standards because of the quality of recirculating water. To apply for an adjustment to the cycles of concentration requirements based on recirculating water quality, an industrial user shall submit a request in writing to the director which includes the following information:*

1. *Historic, current, and projected water quality data for the relevant constituent(s).*

2. *Documentation describing the potential damage to cooling towers or associated equipment or documentation of environmental standards that are likely to be exceeded, whichever applies.*

B. *The director shall grant the request if the director determines that compliance with the cycles of concentration requirements set forth in section 6-602 would likely result in damage to cooling towers or associated equipment or exceedence of federal, state, or local environmental discharge standards because of the quality of recirculating water.*

6-604. Exemption and Cycles of Concentration Adjustment Due to the Quality of Effluent Make-up Water Supplies

A. *The cycles of concentration requirements set forth in section 6-602 do not apply to any effluent-served cooling tower at a large-scale power plant during the first 12 consecutive months in which more than 50 percent of the water supplied to the cooling tower is effluent.*

B. *After the 12-month exemption period expires, the industrial user who uses water at the large-scale power plant may apply to the director for a cycles of concentration adjustment to lower the cycles of concentration requirement for the effluent-served cooling tower if compliance with the requirement would not be possible due to the presence of a limiting constituent in the effluent that supplies the tower. To apply for an alternative cycles of concentration requirement to address such a limiting constituent, an industrial user shall submit a request in writing to the director which includes the following information:*

1. *The limiting constituent that is present in the effluent supplying the tower which results in the need to blow down a greater annual volume of water than that required in section 6-602.*

2. *Documentation describing the concentration at which this limiting constituent should be blown down, and the reason for the alternative blowdown level.*

The director shall grant the request if the director determines that the presence of a limiting constituent in the effluent that supplies the cooling tower results in the need to blow down a greater annual volume of water than that required in section 6-602. Any cycles of concentration adjustment granted pursuant to this paragraph shall apply only while the tower qualifies as an effluent-served cooling tower.

6-605. Alternative Conservation Program

An industrial user who uses water at a large-scale power plant may apply to the director to use conservation technologies other than those prescribed in section 6-602. The director shall approve the use of alternative conservation technologies if both of the following apply:

1. *The industrial user files with the director a detailed description of the proposed alternative technologies and the water savings that can be achieved by the use of the alternative technologies.*

2. *The director determines that the alternative conservation technologies will result in water savings equal to or greater than the savings that would be achieved by the applicable conservation technologies prescribed in section 6-602.*

6-606. Waiver

A. An industrial user who uses water at a large-scale power plant may apply to the director for a waiver of any applicable conservation requirement in section 6-602 by submitting a detailed, long-term plan for beneficial reuse of 100 percent of blowdown water outside the cooling circuit, including an implementation schedule. Reuse of blowdown water includes the discharge of blowdown water into pipes, canals, or other means of conveyance if the discharged water is transported to another location at the plant or off the plant for reuse.

B. The director shall grant a waiver request if the director determines that implementation of the plan will result in the beneficial reuse of 100 percent of blowdown water outside the cooling circuit. If a waiver request is granted, the industrial user shall implement the plan in accordance with the implementation schedule submitted to and approved by the director.

6-607. Monitoring and Reporting Requirements

A. For calendar year 2002 or the calendar year in which water use first commences, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Fourth Management Plan, an industrial user who uses water at a large-scale power plant shall include in its annual report required by A.R.S. § 45-632 the following information:

1. *Cooling capacity in tons of each cooling tower at the facility.*

2. *Frequency of use of each cooling tower at the facility.*

3. *Source of water providing make-up water to each cooling tower at the facility.*

4. *For each cooling tower at the facility that is exempt from cycles of concentration requirements pursuant to section 6-604, subsection A, or for which a cycles of concentration adjustment was granted pursuant to section 6-604, subsection B, the percentage of water served to the tower during the year that was effluent.*

5. *For all fully operational cooling towers subject to cycles of concentration requirements under section 6-602:*

    a. *The total quantity of blowdown water discharged from the cooling towers for each month or partial month when the facility was generating electricity during the calendar year.*

    b. *The total quantity of make-up water used at cooling towers for each month or partial month when the facility was generating electricity during the calendar year.*

    c. *The weighted average concentration of total dissolved solids or other conservative mineral constituent in make-up water and blowdown water at the cooling towers for each month or partial month when the facility was generating electricity during the calendar year, either:*

        1) *Determined by direct analysis, or*

        2) *Calculated based on average monthly electrical conductivity readings if the following conditions have been met: (a) correlations between electrical conductivity and total dissolved solids or between electrical conductivity and another conservative mineral constituent have been established over a period of one year or more in make-up and blowdown water and (b) documentation of these correlation has been provided to the director.*

6. *For each fully operational cooling tower that is exempt from cycles of concentration requirements pursuant to section 6-604, subsection A, or for which an adjusted cycles of concentration requirement was granted pursuant to section 6-603 or section 6-604, subsection B:*

    a. *The total quantity of blowdown water discharged from the cooling tower for each month or partial month when the facility was generating electricity during the calendar year.*

    b. *The total quantity of make-up water used at the cooling tower for each month or partial month when the facility was generating electricity during the calendar year.*

    c. *The weighted average concentration of total dissolved solids or other conservative mineral constituent in make-up water and blowdown water at the cooling tower for each month or partial month when the facility was generating electricity during the calendar year, either:*

        1) *Determined by direct analysis, or*

        2) *Calculated based on average monthly electrical conductivity readings if the following conditions have been met: (a) correlations between electrical conductivity and total dissolved solids or between electrical conductivity and another conservative mineral constituent have been established over a period of one year or more in make-up and blowdown water and (b) documentation of these correlation has been provided to the director.*

7. *All time periods when the facility was not generating electricity.*

8. *The amount of electricity generated each month or each partial month when the facility was generating electricity during the calendar year.*

9. *The estimated quantity of water from any source, including effluent, used during the calendar year for each purpose other than electric power generation purposes.*

B. *A single annual report shall be filed for power plants that are contiguous and owned by the same owner. The report shall describe the combined operations of the power plants as required in subsection A of this section.*

C. *All water measurements required in this section shall be made with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

6.7 LARGE-SCALE COOLING FACILITIES

6.7.1 Introduction

The purpose of cooling tower operation is to cool water that has absorbed the heat load of a heat-generating process. Cooling towers are present at a variety of commercial, industrial, and institutional facilities. Most large-scale cooling users are served by municipal water providers. These facilities are termed "individual users." Water providers are responsible for the individual users' compliance with industrial conservation requirements unless they have notified the Department of the existence of the individual user, in which case the individual user is responsible for compliance (see Chapter 5, section 5-112). Large-scale cooling users served by their own wells are regulated directly by the Department and are responsible for complying with industrial conservation requirements.

6.7.2 Water Use by Large-Scale Cooling Facilities

The main use of water in a cooling tower is to absorb heat from a heat-generating process and dissipate this heat through evaporation. Because a portion of the recirculating water is lost through evaporation, this is considered an "open" recirculating cooling loop.

The equipment served by a cooling tower varies from industry to industry, the most common is equipment used to reject heat from a large heating, ventilation, and air conditioning system (known as an HVAC system). Various equipment configurations are used to transfer heat from its source to the cooled water stream coming from the cooling tower. This transfer typically occurs inside a heat exchanger.

As a portion of cooling tower water evaporates, dissolved minerals become concentrated in the remaining water. Such problems as corrosion, mineral deposition, and biological fouling can result. These conditions reduce cooling efficiency and damage equipment. Chemical treatments including biocides, scale inhibitors, corrosion inhibitors, and addition of sulfuric acid can prolong the time mineral-laden water can safely be recirculated in towers. Mineral-laden water must periodically be discharged to prevent the excessive buildup of minerals and possible precipitation of these minerals onto equipment surfaces. This discharge is known as "blowdown." Replacement water, known as "make-up water," is added back to the tower's recirculating water stream to replace the water lost to evaporation and blowdown.

The "cycles of concentration," or "concentration ratio," achieved in a tower indicate how efficiently water is being used in the tower. Cycles of concentration can be determined by dividing the concentration of a constituent in the blowdown water by the concentration of this same constituent in the make-up water. The concentration of total dissolved solids, a measure of the overall dissolved mineral content in water, is one commonly used constituent for calculating the cycles of concentration.

6.7.3 Large-Scale Cooling Facility Program

Large-scale cooling facilities are defined as facilities with an aggregate cooling capacity of 1,000 tons or more. The following conservation requirements apply to cooling towers that are located at large-scale cooling facilities and that have 250 tons or more of cooling capacity.

- Fully operational towers with 250 tons or more of cooling capacity must achieve either 120 mg/l of silica or 1,200 mg/l of total hardness in recirculating water, whichever is reached first, before blowing down.

- If needed, a facility may apply for an alternative blowdown standard for any tower using treated effluent. During the initial 12-month period during which 50 percent or more of the water used by a tower is effluent, the tower is exempt from blowdown standards.

- If needed, a facility may apply for an alternative blowdown standard for any tower if compliance with blowdown requirements would likely result in damage or exceedence of environmental discharge standards because of the accumulation of a limiting constituent other than silica or total hardness.

- Facilities must record monthly and report annually the volumes of tower make-up water and blowdown water and the concentrations of silica and total hardness or approved alternative constituent in both make-up water and blowdown water.

6.7.4 Future Directions

Currently, the Department is not aware of any large-scale cooling facilities in the Pinal AMA, nor is it aware of any plans to construct such facilities within the AMA during the third management period.

6.7.5 Industrial Conservation Requirements and Monitoring and Reporting Requirements for Large-Scale Cooling Facilities

6-701. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases shall have the following meanings:

1. *"Blowdown water" means water discharged from a cooling tower recirculating water stream to control the buildup of minerals or other impurities in the recirculating water.*

2. *"Conservative mineral constituent" means a component of recirculating water in a cooling tower, the concentration of which is not significantly modified by precipitation, loss to the atmosphere, or the addition of treatment chemicals.*

3. *"Cycles of concentration" means the ratio of the concentration of a conservative mineral constituent or electrical conductivity in the blowdown water to the concentration of this same constituent or electrical conductivity in the make-up water.*

4. *"Effluent-served cooling tower"means a cooling tower served by a make-up water supply which on an annual average basis consists of 50 percent or more effluent.*

5. *"Fully operational cooling tower" means a cooling tower that is functioning to dissipate heat.*

6. *"Large-scale cooling facility" means a facility which has control over cooling operations with a total combined cooling capacity greater than or equal to 1,000 tons. For the purposes of this definition, the minimum cooling tower size which shall be used to determine total facility cooling capacity is 250 tons. A large-scale cooling facility does not include a large-scale power plant that utilizes cooling towers to dissipate heat.*

7. *"Large-scale power plant" means an industrial facility that produces or is designed to produce more than 25 megawatts of electricity.*

8. *"Limiting constituent" means a chemical, physical, or biological constituent present in recirculating cooling tower water which, due to potential physical or biological factors or due to potential exceedence of any federal, state, or local environmental standards upon discharge as blowdown, should not be allowed to accumulate in recirculating cooling tower water above a certain concentration.*

9. *"Make-up water" means the water added back into the cooling tower recirculating water stream to replace water lost to evaporation, blowdown, or other mechanisms of water loss.*

6-702. Conservation Requirements

A. Conservation Requirements

Beginning on January 1, 2002 or upon commencement of water use, whichever occurs later, and continuing thereafter until the first compliance date for any substitute conservation

requirement in the Fourth Management Plan, an industrial user who uses water at a large-scale cooling facility shall comply with the following requirement:

Each fully operational cooling tower with greater than or equal to 250 tons of cooling capacity at the facility shall achieve a cycles of concentration level that results in blowdown water being discharged at an average annual minimum of either 120 mg/l silica or 1,200 mg/l total hardness, whichever is reached first.

B. Exemptions and Alternative Blowdown Standards

1. *The requirement set forth in subsection A of this section, does not apply to a large-scale cooling facility in any year in which 100 percent of facility blowdown water is beneficially reused.*

2. *The requirement set forth in subsection A of this section does not apply to any effluent-served cooling tower at a large-scale cooling facility during the first 12 consecutive months in which more than 50 percent of the water supplied to the cooling tower is effluent. After the 12-month period expires, the person using water at an effluent-served cooling tower may apply to the director to use an alternative blowdown level from that required in subsection A of this section if compliance with the blowdown requirement would not be possible due to the presence of a limiting constituent other than silica or total hardness in the effluent supplying the cooling tower. To apply for an alternative blowdown level to address such a limiting constituent, an industrial user shall submit a request in writing to the director which includes the following information:*

   a. *The limiting constituent other than silica or total hardness that is present in the effluent supplying the tower which results in the need to blow down a greater annual volume of water than that required under subsection A of this section.*

   b. *Documentation describing the concentration at which this limiting constituent should be blown down, and the reason for the alternative blowdown level.*

   The director shall grant the request if the director determines that the presence of a limiting constituent other than silica or total hardness in the effluent supplying the cooling tower results in the need to blow down a greater annual volume of water than that required under subsection A of this section. Any alternative blowdown level granted pursuant to this paragraph shall apply only while the tower qualifies as an effluent-served tower.

3. *An industrial user may apply to the director to use an alternative blowdown level from that required in subsection A of this section if compliance with the blowdown requirement would likely result in damage to cooling towers or associated equipment or exceedence of federal, state or local environmental discharge standards because of the accumulation of a limiting constituent other than silica of total hardness in recirculating water. To apply for an alternative blowdown level for such a limiting constituent, an industrial user shall submit a request in writing to the director which includes the following information:*

   a. *Historic, current and projected water quality data for the relevant limiting constituent(s).*

b. Documentation describing the potential damage to cooling towers or associated equipment, or documentation of environmental standards that are likely to be exceeded, whichever applies.

The director shall grant the request if the director determines that compliance with the blowdown level set forth in subsection A of this section would likely result in damage to cooling towers or associated equipment or exceedence of federal, state, or local environmental discharge standards because of the accumulation of a limiting constituent other than silica or total hardness in recirculating water.

6-703. Monitoring and Reporting Requirements

For calendar year 2002 or the calendar year in which water use first commences, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the Fourth Management Plan, an industrial user who uses water at a large-scale cooling facility shall include in its annual report required by A.R.S. § 45-632 the following information for all cooling towers with 250 tons or more of cooling capacity at the facility:

1. Capacity in tons of each cooling tower.

2. Number of days per month that each cooling tower was fully operational.

3. For each cooling tower that is exempt from cycles of concentration requirements or for which an alternative blowdown level has been granted pursuant to section 6-702, subsection B, paragraph 2, the percentage of water served to the tower during the year that was effluent.

4. The quantity of water from any source, specified by source, which was used for make-up water on a monthly basis during the calendar year as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

5. The quantity of water which was blown down on a monthly basis during the calendar year as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

6. The average monthly concentrations of silica, total hardness or other approved limiting constituent established under section 6-702 subsection B, paragraph 2 or 3, in make-up and blowdown water for those portions of each month when the cooling towers were fully operational during the calendar year, reported in mg/l or other measurement units established under section 6-702, subsection B, paragraph 3, and either:

a. Determined by direct analysis; or

b. Calculated based on average monthly electrical conductivity readings for the portions of each month when cooling towers were fully operational if the following conditions have been met: (a) correlations between electrical conductivity and silica, between electrical conductivity and total hardness, or between electrical conductivity and another approved limiting constituent established pursuant to section 6-702 subsection B, paragraph 2 or 3, have been established over a period of one year or more in make-up and blowdown water; and (b) documentation of these correlations has been provided to the director.

6.8 DAIRY OPERATIONS

6.8.1 Introduction

The Department regulates dairy operations that annually house a monthly average of 100 or more lactating cows per day.

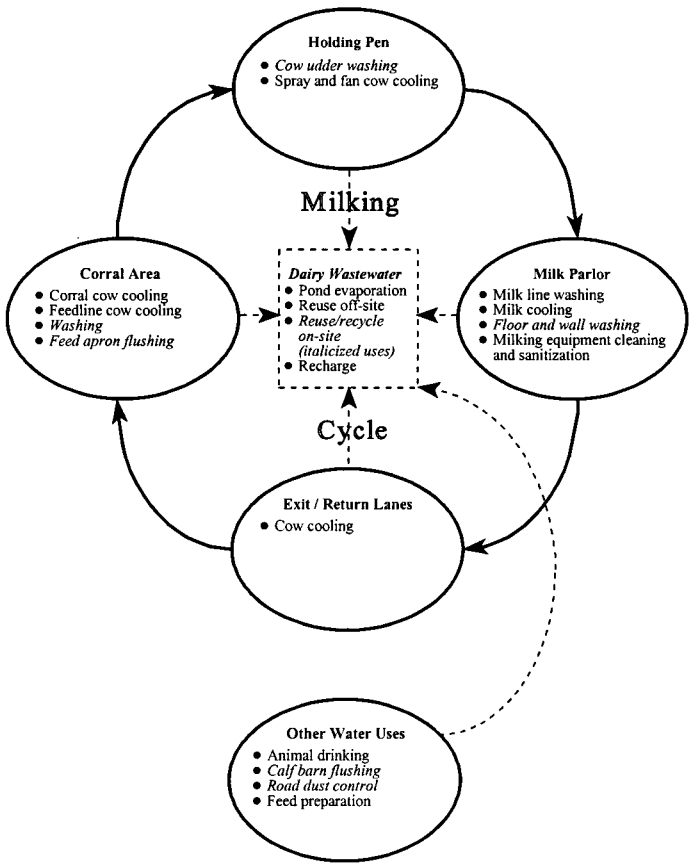
6.8.2 Water Use by Dairy Operations

There are currently nine dairy operations in the Pinal AMA. These facilities hold Type 1 and Type 2 grandfathered rights and groundwater withdrawal permits totaling more than 2,100 acre-feet. Water use by dairies in 1995 was nearly 1,000 acre-feet, or just less than 48 percent of their total annual allotments. Dairy water use has been steadily increasing since 1989, and the Department projects this trend will continue through the year 2025. Dairy operations are a small, but growing industrial water user in the AMA. Many of Arizona's large, established dairies are currently located in the Chandler/Gilbert area of the Phoenix AMA. However, this area is rapidly being urbanized and many of the dairies are relocating. It is anticipated that a number of these dairies will relocate to the Pinal AMA.

Figure 6-2 shows how water is used at a dairy. A significant amount of water is used for the milking cycle. The first step in the milking cycle at most dairies is moving the cows into a holding pen, where the udders are washed before milking. Sprinklers, arranged in a grid pattern on the floor of the pen, are turned on to wash the udders. The cows may be cooled during udder washing to enhance milk production. The animals are then moved to the milking parlor for milking, after which they are returned to the corral area through return lanes. Each time the cycle is completed, the holding pen and parlor areas are cleaned, milk lines are washed, milking equipment is cleaned and sanitized, and manure is removed.

There are a number of dairy management decisions that affect water use. Animal cooling to reduce heat stress and enhance milk production is an increasingly common management practice. Cooling is usually done when temperatures exceed 85 to 90 degrees Fahrenheit and may be done at a number of points in the milking cycle, including the holding pen corral, at the parlor exit, along the fenceline feeding area, or in the corral area. Approximately 95 percent of dairies in the AMAs cool their cows during some portion of the milking cycle. Cooling practices have increased during the past decade and are expected to continue to increase in the future. Whereas at many existing dairies lactating cows are often cooled at only one or two of the possible locations, newly designed dairies incorporate cooling wherever possible.

FIGURE 6-2
WATER USE AT A TYPICAL DAIRY OPERATION



Italized items can use reused and/or recycled water
Not all water uses shown on this chart exist at every dairy

Milking cycle frequency is another management decision that will affect water use. Cows may be milked two, three, or even four times daily. Increasing the number of milking cycles per day will increase water use. Dairy managers evaluate the benefits of milking two or three times per day based upon parlor capacity, milk yield, staffing, and other economic factors. If future market demands require increasing milk pounds of production per cow, milking up to four times a day could become commonplace.

Aside from the milking cycle, water is used for drinking needs, controlling dust, and, at some dairies, feed preparation. Water used for drinking needs varies, depending upon whether the animal present at the facility is a lactating cow (a cow producing milk) or a non-lactating animal (calves, heifers, dry cows, bulls, and steers). A lactating cow drinks an average of 30 gallons of water per day with some seasonal variation. By contrast, a non-lactating animal drinks an average of 15 gallons per day with some seasonal variation.

Whether replacement animals and non-lactating animals are housed on-site or off-site can significantly affect water use. Each dairy keeps lactating and mature dry cows on-site at a ratio that remains relatively constant throughout the year with some variation due to weather and breeding. Another management decision is whether replacement animals, such as calves and heifers, are housed on-site. Typically, if replacement animals are housed on-site, the total number of replacement animals plus mature dry cows equals the number of lactating cows. Some dairy managers prefer to purchase replacement animals as needed or raise the animals in cooler climates until they near calving age. Approximately 40 percent of Arizona dairies raise their replacement animals off-site.

Within the milking cycle, the dairy industry practices that have the most significant water conservation potential are the udder washing process, the practice of water recycling, and, to a lesser extent, cleaning and sanitization. The typical udder washing cycle consists of a one-minute washing, a two-minute break, followed by a three-minute washing. At many dairies, more water is used in the udder washing process during the summer months, though no increase is warranted for sanitation reasons. Summer water use can easily be reduced with little or no additional management or equipment costs. Many dairies have invested in automatic timers to manage the udder wash system. Timers reduce the potential for excessive manual washing, provided the timer is used appropriately. Proper management is the best way to control water waste, and the use of automatic timers can result in significant water savings. Other factors affect the amount of water used for udder washing. Regular and frequent washing of the corral walkway areas reduces the potential for soiled udders and thus reduces wash water needs. Periods of wet weather result in muddy corrals requiring longer udder washing cycles or increased washing of corral walkways and milking areas.

Another important water conservation practice for dairies is recycling of wastewater generated by the dairy. Wastewater may be conveyed to a lagoon where it evaporates, delivered off-site for non-dairy uses (such as irrigating crops), or recycled and reused at the dairy. There are many opportunities for recycling at a dairy. Milk cooling using vacuum pumps produces discharged water that can be captured and used in the udder washing cycle or for certain other washing and cleaning purposes. At some facilities, and depending upon how the recycled water is used initially, this water can be captured a second time and used again. For example, recycled water used for udder washing may be recycled again to wash corral walkways. Recycling offers the dairy manager several benefits including: lower water costs, less wastewater to dispose of, less free-standing water, drier conditions, and cleaner cows. Recycling should be evaluated and implemented wherever feasible in new dairies. Health and sanitary requirements may prohibit the use of recycled water for certain water uses at a dairy.

At many dairies, the amount of water used for cleaning and sanitizing the holding pen, milking parlor, and milk transport lines after each milking increases during the summer months, though no increase may be warranted. Summer water use for this purpose can easily be reduced with little or no additional management or equipment costs.

6.8.3 Program Development and Issues

During the first management period, dairy operations did not have any specific conservation requirements. When the Second Management Plan was developed, the Department conducted a study to identify dairy water use patterns, processes, and associated water use to determine conservation requirements for dairy operations. Several dairies were visited during the study. Experts from the University of Arizona reviewed and supplemented the study and had significant input to the conservation requirements. Conservation requirements for the second management period established a maximum annual water allotment for dairies beginning in 2000. The annual allotment was determined using per animal water use needs for lactating cows and non-lactating animals and could vary depending upon the number of animals at the facility. Upon application, the Department could approve an additional allocation of water for a dairy operation above its annual allotment if the dairy operation demonstrated that milking, sanitary, or cooling needs would require more water.

During the second management period, rapid changes in cooling technologies and the increased diversity in dairy size and design have made it more difficult to expect all dairies to be able to conform to an allotment based conservation requirement. In an effort to have higher milk production efficiency, newer dairies tend to employ more cooling practices and incorporate more methods to recycle or reuse water.

The Department has been informed by the dairy industry that future facilities will have to be larger and utilize these new cooling technologies in order to be economically competitive. These practices are designed to increase the milk yield per lactating cow and will require more water than historical use indicates. The conservation program for the third management period provides dairies the opportunity to choose one of two conservation programs. Dairies may opt to have an allotment-based program identical to the Second Management Plan requirements, or dairies may apply for a program in which the requirements are specified best management practices (BMPs).

6.8.4 Dairy Operations Conservation Program

6.8.4.1 Allotment Based Requirements

The amount of water required by a dairy depends upon the number of cows and non-lactating animals housed at the dairy, herd composition, and dairy management practices. Table 6-2 summarizes daily water needs for each dairy process assuming use of appropriate water conservation technology and practices. The water needs listed are based upon two assumptions: (1) milking is done three times per day per lactating animal, and (2) cooling is done during the milking cycle for at least a portion of the herd.

The assumptions of Table 6-2 are the basis for the maximum annual water allotment for dairy operations. When calculating the annual allotment, lactating cows are allotted 105 gallons per animal per day (GAD) and non-lactating animals are allotted 20 GAD. The allotment is calculated annually and will vary with the average daily number of lactating cows and non-lactating animals present at the dairy each year.

Upon application, the Department may approve an additional allocation of water for a dairy operation above its annual allotments if the dairy operation demonstrates that one or more of the following conditions exist at the dairy:

- Milking is being done more than three times daily.
- Technologies that are designed to achieve industry health and sanitation objectives, such as the recommended pre-milking sanitation method, are being used.
- Animal cooling technologies designed to increase milk production are being used.

TABLE 6-2
WATER NEEDS AT A TYPICAL DAIRY

Operation	Water Use Allocation (gallons per day)	
	Lactating Cow	Non-Lactating Animal
Drinking needs[1]	30	15
Udder washing - based on 72 minutes/day at 8 gallons/minute; 16 cows per milking (two per group). (Varies with number of milkings per day.[1])	35	0
Barn cleanup and sanitizing. (Varies with number of milkings per day.[1])	20	0
Animal cooling management option (site-specific)	10	0
Calf barn cleanup	0	5
Milk cooling tower (if present)	5	0
Miscellaneous	5	0
Total	105	20

[1] Assumes three milkings per day.

In consideration of wet weather, the Department has included a three-year averaging provision in the maximum annual water allotment for the third management period. The water use of three consecutive years can be averaged and used to determine compliance with the annual allotment.

6.8.4.2 Best Management Practices Requirements

As an alternative to the annual allotment requirement, a dairy operation may submit an application to the director under the Best Management Practices Program (BMP Program). This program requires implementation of conservation and management practices to maximize efficiency in the following water use categories:

- Delivery of drinking water for dairy animals;
- Udder washing and milk parlor cleaning;
- Corral maintenance and design;
- Cleaning and sanitizing milking equipment;
- Dust control, calf housing cleaning, and feed apron flushing;
- Dairy animal cooling; and
- Feed preparation.

Implementation of all the standard BMPs listed in Appendix 6B will have a specific measurable result. While most of the standard BMPs are applicable to all dairies, the water use activities associated with some of the standard BMPs may not exist at all dairies. If a dairy cannot implement a standard BMP, the dairy may apply to implement a substitute BMP with a specific measurable result that demonstrates a water savings equivalent to the water savings associated with the standard BMP. If a substitute BMP is not possible, the dairy may apply for a waiver of the standard BMP. The director may grant a waiver only for the following standard BMPs: (1) BMP 2.1.2 (Udder Wash System); (2) BMP 2.2.2 (Milking Parlor Floor and Wall Washing); (3) BMP 4.1.1 (Milk Cooling and Vacuum Pump); (4) all of the standard BMPs in Water Use Category No. 5 (Dust Control, Calf Housing Cleaning, and Feed Apron Flushing); (5) all of the

standard BMPs in Water Use Category No. 6 (Dairy Animal Cooling); and (6) all of the standard BMPs in Water Use Category No. 7 (Dairy Animal Feed Preparation).

Five years after a dairy operation is accepted for regulation under the BMP Program, the director will review the dairy's BMPs to determine if they are still appropriate. If the BMPs are no longer appropriate due to an expansion of the dairy or a change in management practices, the director will require a modification to the BMPs.

6.8.5 Future Directions

Although newer dairies tend to use more water for cow cooling than older dairies by employing more cooling technologies and practices, thoughtful design will allow dairies to reuse and recycle more water than they have in the past. The latest "state of the art" dairies even effectively collect or use rainfall. Fourth management period conservation requirements may need to be adjusted to reflect the increased presence of these changes. Any changes to the allotment, however, will need to be based on verifiable data.

6.8.6 Industrial Conservation Requirements and Monitoring and Reporting Requirements for Dairy Operations

6-801. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases used in sections 6-802 through 6-805 of this chapter shall have the following meanings:

1. *"Dairy animal" means a lactating cow or a non-lactating animal present at a dairy operation.*

2. *"Dairy operation" means a facility that houses an average of 100 or more lactating cows per day during a calendar year as calculated in section 6-802.*

3. *"Dairy wastewater" means any water which has been put to a beneficial use at the dairy operation, including water containing dairy animal wastes.*

4. *"Lactating cow" means any cow that is producing milk which is present on-site at a dairy operation and receives water through the dairy operation's watering system.*

5. *"Non-lactating animal" means a calf, heifer, mature dry cow, bull, or steer that is present on-site at a dairy operation and receives water through the dairy operation's watering system.*

6-802. Maximum Annual Water Allotment Conservation Requirements

A. Maximum Annual Water Allotment

Beginning on January 1, 2002 or upon commencement of water use, whichever is later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management Plan, an industrial user shall not withdraw, divert, or receive water for use at a dairy operation during a calendar year in a total amount that exceeds the dairy operation's maximum annual water allotment for the year as calculated in subsection B below, unless the industrial user applies for and is accepted into the Best Management Practices Program (BMP Program) described below in section 6-804.

B. Calculation of Maximum Annual Water Allotment

A dairy operation's maximum annual water allotment for a calendar year shall be determined as follows:

1. *Calculate the average daily number of lactating cows and non-lactating animals which are present during the calendar year. The average daily number of lactating cows and non-lactating animals present during the calendar year shall be calculated as follows:*

    a. *Determine the total number of lactating cows and non-lactating animals present at the dairy operation on the last day of each month during the calendar year.*

    b. *For each category of animal, add together the total number of such animals present at the dairy operation on the last day of each month during the year in question, and*

then divide the result by 12. The quotient is the average daily number of lactating cows and non-lactating animals present during the calendar year.

2. *Calculate the dairy operation's maximum annual water allotment for the calendar year as follows:*

   a. *Multiply the average daily number of lactating cows present during the calendar year by 105 gallons per animal per day (GAD) and then convert to acre-feet per year as follows:*

$$C_L \times \frac{105\ GAD}{325{,}851\ g/af} \times d/yr = \text{Maximum annual water allotment for lactating cows (acre-feet per year)}$$

   Where: C_L = *Average daily number of lactating cows*

   GAD = *Gallons per animal per day*
   g/af = *Gallons per acre-foot*
   d/yr = *Days in the year*

   The result is the dairy operation's maximum annual water allotment for lactating cows for the calendar year.

   b. *Multiply the average daily number of non-lactating animals present during the calendar year by 20 GAD and then convert to acre-feet per year as follows:*

$$A_N \times \frac{20\ GAD}{325{,}851\ g/af} \times d/yr = \text{Maximum annual water allotment for non-lactating animals (acre-feet per year)}$$

   Where: A_N = *Average daily number of non-lactating animals*

   GAD = *Gallons per animal per day*
   g/af = *Gallons per acre-foot*
   d/yr = *Days per year*

   The result is the dairy operation's maximum annual water allotment for non-lactating animals for the calendar year.

   c. *Add the dairy operation's maximum annual water allotment for non-lactating animals for the calendar year as calculated in subparagraph b of this paragraph and the dairy operation's maximum annual water allotment for lactating cows for the calendar year as calculated in subparagraph a of this paragraph. The sum is the maximum annual water allotment for the dairy operation for the calendar year, except as provided in subparagraph d of this paragraph.*

   d. *Upon application, the director may approve an additional allocation of water for the dairy operation consistent with industry health and sanitation objectives if the dairy operation requires more than its maximum annual water allotment because of one or more of the following:*

      1. *milkings per lactating cow occur more than three times daily,*

2. *technologies are used to achieve industry health and sanitation objectives that require additional water use or,*

3. *technologies are designed and/or implemented for cooling lactating cows and non-lactating animals which increase milk production.*

3. *Nothing in this section shall be construed to authorize a person to use more water from any source than the person is entitled to use pursuant to a groundwater or appropriable water right or permit held by the person. Nor shall this section be construed to authorize a person to use water from any source in a manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.*

6-803. Compliance with Maximum Annual Water Allotment

An industrial user who uses water at a dairy operation is in compliance for a calendar year with the dairy operation's maximum annual water allotment if the director determines that either of the following applies:

1. *The volume of water withdrawn, diverted, or received during the calendar year for use at the dairy operation, less the volume of dairy wastewater delivered from the dairy operation to the holder of a grandfathered groundwater right for a beneficial use, is equal to or less than the dairy operation's maximum annual water allotment for the calendar year; or*

2. *The three-year average volume of water withdrawn, diverted, or received for use at the dairy operation during that calendar year and the preceding two calendar years is equal to or less than the dairy operation's three-year average maximum annual water allotment for that calendar year and the preceding two calendar years. In calculating the three-year average volume of water withdrawn, diverted, or received for use at the dairy operation, the volume of dairy wastewater delivered from the dairy operation to the holder of a grandfathered right for a beneficial use shall not be counted.*

6-804. Best Management Practices Program Conservation Requirements

A. Criteria for Approval of Application

An industrial user who uses water at a dairy operation may apply for regulation under the BMP Program by submitting an application on a form provided by the director. The director shall approve a complete and correct application for regulation under the BMP Program if the director determines that the applicant will implement all of the standard BMPs described in Appendix 6B, unless the director approves a substitution of a standard BMP under subsection D of this section or a waiver of a standard BMP under subsection E of this section. If the director approves a substitution of a standard BMP, the director shall approve the application if the director determines that the applicant will implement the substitute BMP or BMPs in addition to any remaining standard BMPs.

B. Exemption from Maximum Annual Water Allotment Conservation Requirements

An industrial user accepted for regulation under the BMP Program is exempt from the maximum annual water allotment conservation requirements set forth in section 6-802 beginning on January 1 of the first calendar year after the industrial user's application for the BMP Program is approved, unless the director approves an earlier date.

*C. **Compliance with Best Management Practices Program***

Beginning on a date established by the director and continuing thereafter until the first compliance date for any substitute conservation requirement established in the Fourth Management Plan, an industrial user accepted for regulation under the BMP Program shall comply with all standard BMPs listed in Appendix 6B, unless the director approves a substitution of a standard BMP under subsection D of this section or a waiver of a standard BMP under subsection E of this section. If the director approves a substitution of a standard BMP, the industrial user shall comply with the substitute BMP or BMPs in addition to any remaining standard BMPs. The standard BMPs listed in Appendix 6B are broken into the following seven categories: (1) delivery of drinking water for dairy animals; (2) udder washing and milking parlor cleaning; (3) corral design and maintenance; (4) cleaning and sanitizing milking equipment; (5) dust control, calf housing cleaning, and feed apron flushing; (6) dairy animal cooling; and (7) dairy animal feed preparation.

*D. **Substitution of Best Management Practices***

1. *The director may allow an industrial user applying for the BMP Program to replace a standard BMP listed in Appendix 6B with a substitute BMP if the director determines that the standard BMP cannot be achieved and that implementation of the substitute BMP will result in water use efficiency equivalent to that of the standard BMP. To apply for a substitution of a standard BMP, the industrial user shall include in its application for the BMP Program an explanation of why the standard BMP is not achievable and a description of how the substitute BMP will result in water use efficiency equivalent to that of the standard BMP.*

2. *An industrial user regulated under the BMP Program may apply to the director for a substitution of an existing BMP that is no longer appropriate for the industrial user's dairy operation. The director may allow the industrial user to replace the existing BMP with a substitute BMP if the director determines that the substitute BMP will result in water use efficiency equivalent to that of the existing BMP.*

*E. **Waiver of Best Management Practices***

1. *The director may waive a standard BMP listed in paragraph 3 of this subsection if the director determines that the standard BMP cannot be achieved and that no substitute BMP is appropriate. To apply for a waiver of a standard BMP listed in paragraph 3, the industrial user shall include in its application for the BMP Program an explanation of why the standard BMP is not achievable and why no substitute BMP is appropriate.*

2. *An industrial user regulated under the BMP Program may apply to the director for a waiver of an existing BMP listed in paragraph 3 of this subsection if the BMP is no longer appropriate for the industrial user's dairy operation. The director may waive the existing BMP if the director determines that the existing BMP is no longer appropriate for the industrial user's dairy operation and the that no substitute BMP is appropriate.*

3. *Only the following standard BMPs may be waived by the director under this subsection: (1) BMP 2.1.2 (Udder Wash System); (2) BMP 2.2.2 (Milking Parlor Floor and Wall Washing); (3) BMP 4.1.1 (Milk Cooling and Vacuum Pump); (4) all of the standard BMPs in Water Use Category No. 5 (Dust Control, Calf Housing Cleaning and Feed Apron Flushing); (5) all of the standard BMPs in Water Use Category No. 6 (Dairy*

Animal Cooling); and (6) all of the standard BMPs in Water Use Category No. 7 (Dairy Animal Feed Preparation).

F. Five Year Review of Best Management Practices

Five years after an industrial user is accepted for regulation under the BMP Program, the director shall review the industrial user's BMPs to determine whether any changes in the BMPs are warranted. If the director determines that any of the existing BMPs are no longer appropriate due to an expansion of the dairy operation or a change in management practices at the operation, the director shall notify the industrial user in writing of that determination and the director and the industrial user shall make a good faith effort to stipulate to a modification of the BMPs so that they are appropriate for the expanded operation or the change in management practices.

If the director and the industrial user are unable to stipulate to a modification to the BMPs within 180 days after the director notifies the industrial user of the determination that one or more of the existing BMPs are no longer appropriate or such longer time as the director may agree to, the industrial user shall no longer be regulated under the BMP Program but shall thereafter be required to comply with the maximum annual water allotment conservation requirements set forth in section 6-802.

If the director and the industrial user stipulate to a modification of the BMPs, the industrial user shall comply with the modified BMPs by a date agreed upon by the director and the industrial user and shall continue complying with the modified BMPs until the first compliance date for any substitute conservation requirement in the Fourth Management Plan.

G. Change in Ownership of Dairy Operation

1. *If an industrial user regulated under the BMP Program sells or conveys the dairy operation to which the BMPs apply, the new owner of the dairy operation shall continue to be regulated under the BMP Program until January 1 of the first calendar year after acquiring ownership of the dairy operation. Except as provided in paragraph 2 of this section, beginning on January 1 of the first calendar year after acquiring ownership of the dairy operation, the new owner shall comply with the maximum annual water allotment conservation requirements set forth in section 6-802. The new owner may at any time apply for regulation under the BMP Program.*

2. *If the new owner submits a complete and correct application for regulation under the BMP Program prior to January 1 of the first calendar year after acquiring ownership the of the dairy operation, the new owner shall continue to be regulated under the BMP Program until the director makes a determination on the application. If the director denies the application, the new owner shall be required to comply with the maximum annual water allotment conservation requirements set forth in section 6-802 immediately upon notification of the denial or January 1 of the first calendar year after acquiring ownership of the dairy, whichever is later. If the director approves the application, the new owner shall continue to be regulated under the BMP Program until the first compliance date for any substitute conservation requirement in the Fourth Management Plan.*

6-805. Monitoring and Reporting Requirements

For the calendar year 2002 or the calendar year in which water use is commenced at the dairy operation, whichever occurs later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirements in the Fourth Management Plan, an industrial user who uses water at a dairy operation shall include the following information in its annual report required by A.R.S. § 45-632:

1. *The total quantity of water from any source, including effluent, withdrawn, diverted, or received during the calendar year, for use by the dairy operation as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

2. *The total quantity of water delivered during the calendar year to any uses other than the dairy operation from the well or wells which serve the dairy operation as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

3. *The total quantity of dairy wastewater delivered to grandfathered rights other than the dairy operation, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R-12-15-901, et seq.*

4. *The total number of lactating cows and non-lactating animals which were present on-site at the dairy operation on the last day of each month during the calendar year.*

5. *If the dairy operation is regulated under the BMP Program, any documentation as required by the director which demonstrates compliance with the program.*

6.9 CATTLE FEEDLOT OPERATIONS

6.9.1 Introduction

The Department regulates cattle feedlot operation that house and feed an average of 100 or more beef cattle per day during a calendar year.

6.9.2 Water Use by Cattle Feedlot Operations

In the Pinal AMA, there are currently 17 cattle feedlot operations, which hold Type 2 grandfathered rights totaling 5,740 acre-feet. In 1995, water use by cattle feedlots was 1,334 acre-feet of water, or slightly greater than 23 percent of their total annual allotments. Eight facilities accounted for almost all of this water use. Cattle feedlots use water for three purposes: livestock watering, dust control, and miscellaneous uses. The amount of water required for each of these purposes varies with the number of cattle processed by a facility. Livestock water use is usually measured in GAD, and cattle feedlots in the AMA have averaged 13 GAD. However, it appears that more stringent air quality regulations with respect to dust control may cause an increase in the water use. Growth in this subsector is expected to remain fairly static.

The only component of cattle feedlot water use having a significant conservation potential is dust control watering. Cattle feedlots control dust by applying water to the land surface using either a mobile tank and a large gun sprinkler, portable water lines with small nozzles, or a permanently installed sprinkler system. Each of these methods provides satisfactory dust control if water coverage is adequate and enough water is applied. If a permanent sprinkler system is installed, sprinkler heads should be selected and arranged to eliminate overspray, water application in excess of infiltration rates, and runoff. Overall management of the system is the most important factor in efficient dust control watering. Many cattle feedlots could conserve water by using proper management techniques for their dust control water systems. Proper management techniques include the removal of excess manure to less than two inches in depth and increasing the number of cattle per pen to increase pen moisture. Dust can also be controlled by surfacing roads between pens. All of these management practices reduce dust, thereby reducing the need to apply water.

Conservation potential also exists in the areas of landscape watering and water system losses. Because most cattle feedlot operations are already using a float control system, the latest available conservation technology for cattle drinking water systems, no significant water savings can be achieved in this area.

6.9.3 Program Development and Issues

Starting with the First Management Plan, cattle feedlot operations in the Pinal AMA were assigned a maximum annual water allotment based on reasonable daily maximum requirements for animal drinking, dust control, and miscellaneous water use needs. In addition, cattle feedlot operations were required to use specific conservation technologies during the first management period. This requirement was dropped for the second management period, and the Department only required that each facility comply with its maximum annual water allotment, which essentially remained unchanged from that in the First Management Plan.

6.9.4 Cattle Feedlot Operations Conservation Program

The conservation requirements for cattle feedlot operations for the third management period remain unchanged from those in the Second Management Plan. The conservation requirements for cattle feedlot operations in the Third Management Plan include a maximum annual water allotment for each facility based on the assumed use of specific conservation technologies. For the Second Management Plan, representatives from the cattle feedlot industry and cattle feedlot experts from the University of Arizona

College of Agriculture reviewed the equation used to determine the maximum annual water allotment for the first management period and verified that the equation allocates a reasonable amount of water.

The equation is based on the number of gallons of water reasonably required per animal per day. To determine this amount, three components of cattle feedlot water use were considered: (1) cattle drinking water requirements, (2) dust control watering requirements, and (3) other uses. The amount of water required for each component varies with the number of cattle processed by the feedlot. Cattle drinking water requirements include water intake, water spilled while drinking, and evaporation losses from watering tanks. Drinking water requirements are estimated to be 15 GAD. Dust control watering requires approximately 10 GAD. Other uses, including water used for feed mixing, health and environmental controls, system losses, and fire protection total 5 GAD. Total water requirements for a cattle feedlot operation are 30 GAD. These requirements are continued for the third management period.

6.9.5 Industrial Conservation Requirements and Monitoring and Reporting Requirements for Cattle Feedlot Operations

6-901. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases used in sections 6-902 through 6-903 of this chapter, shall have the following meanings:

1. *"Beef cattle" means cattle or calves fed primarily for meat production.*

2. *"Cattle feedlot operation" means a facility that houses and feeds an average of 100 or more beef cattle per day during a calendar year as calculated in section 6-902.*

6-902. Maximum Annual Water Allotment Conservation Requirements

A. Maximum Annual Water Allotment

Beginning on January 1, 2002 or upon commencement of water use, whichever is later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management plan, an industrial user shall not withdraw, divert, or receive water for use at a cattle feedlot operation during a calendar year in a total amount that exceeds the cattle feedlot's maximum annual water allotment for the year as calculated in subsection B below.

B. Calculation of Maximum Annual Water Allotment

A cattle feedlot operation's maximum annual water allotment for a calendar year shall be determined as follows:

1. *Calculate the average daily number of beef cattle present during the calendar year. The director shall calculate the average daily number of beef cattle present during the calendar year as follows:*

    a. *Determine the total number of beef cattle present at the cattle feedlot operation on the last day of each month during the calendar year.*

    b. *Add together the total number of beef cattle present at the cattle feedlot operation on the last day of each month during the year in question and then divide the result by 12. The quotient is the average daily number of beef cattle present at the cattle feedlot operation during the calendar year.*

2. *Multiply the average daily number of beef cattle present at the cattle feedlot operation during the calendar year by a water allotment of 30 gallons per animal per day (GAD) and then convert to acre-feet per year as follows:*

C_B x $\frac{30\ GAD}{325{,}851\ g/acre\text{-}foot}$ x d/yr = *Maximum annual water allotment for the cattle feedlot operation (acre-feet/year)*

Where: C_B = *Average daily number of beef cattle*
GAD = *Gallons per animal per day*
g/acre-foot = *Gallons per acre-foot*
d/yr = *Days in the year*

C. Compliance with Maximum Annual Water Allotment

An industrial user who uses water at a cattle feedlot operation is in compliance for a calendar year with the cattle feedlot operation's maximum annual water allotment if the director determines that either of the following applies:

1. *The volume of water withdrawn, diverted, or received during the calendar year for use at the cattle feedlot operation is equal to or less than the cattle feedlot operation's maximum annual water allotment for the calendar year; or*

2. *The three-year average volume of water withdrawn, diverted, or received for use at the cattle feedlot operation during that calendar year and the preceding two calendar years is equal to or less than the cattle feedlot operation's three-year average maximum annual water allotment for that calendar year and the preceding two calendar years.*

D. *Nothing in this section shall be construed to authorize a person to use more water from any source than the person is entitled to use pursuant to a groundwater or appropriable water right or permit held by the person. Nor shall this section be construed to authorize a person to use water from any source, including effluent, in a manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.*

6-903. Monitoring and Reporting Requirements

For calendar year 2002 or the calendar year in which water use is first commenced at the cattle feedlot operation, whichever occurs later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirements in the Fourth Management Plan, an industrial user who uses water at a dairy operation shall include the following information in its annual report required by A.R.S. § 45-632:

1. *The total quantity of water from any source, including effluent, withdrawn, diverted, or received during the calendar year for use at the cattle feedlot operation as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*

2. *The total number of beef cattle which were present on-site at the cattle feedlot operation on the last day of each month during the calendar year.*

6.10 NEW LARGE LANDSCAPE USERS

6.10.1 Introduction

New large landscape users are those industrial users with a substantial water-intensive landscaped area that was planted after January 1, 1990. The conservation program differentiates between two types of large landscape users: non-residential facilities that are hotels or motels and non-residential facilities that are not hotels or motels. If the facility is not a hotel or motel, conservation requirements apply to areas in excess of 10,000 square feet. If the facility is a hotel or motel, requirements apply to areas in excess of 20,000 square feet. If the facility has more than 10 acres of water-intensive landscaped area, it is defined as a turf-related facility and is subject to the conservation requirements discussed in section 6.3 of this chapter.

If a facility has in excess of 10 acres of water-intensive landscaped area, it is defined as a turf-related facility and is subject to specific conservation requirements discussed elsewhere in this chapter.

6.10.2 Water Use by New Large Landscape Users

In the Pinal AMA, no new large landscape users with water rights were identified by the Department during the second management period.

Water use associated with landscaping is directly related to the size of the landscaped area, the types of vegetation, and the efficiency of the irrigation method used. Many municipal water providers have ordinances that place some conditions on new non-residential landscaping. While these ordinances have multiple objectives, they also have provisions that address water conservation. Some of these provisions include the placement of plants based on their water needs, planting of low water use plants in certain areas, and preservation of native vegetation.

6.10.3 Program Development and Issues

The distinction in the program between hotel or motel landscapes and landscapes that are associated with other types of facilities is intended to recognize that economic competition within the industry may pressure certain hotel and motel developments to plant high water-using landscape plant material.

The Department believes that consultant studies done for the Second Management Plan still apply. These studies indicated that significant reductions in landscape water use can be achieved using the following techniques:

- Improving water application efficiency through proper irrigation scheduling, use of more sophisticated control systems, conversion to drip irrigation, and irrigation systems designed to accommodate plants with similar water needs;
- Reducing the size and perimeter of turfed areas and limiting their placement to functional use areas and areas of high visual impact;
- Using drought-resistant plant species adapted to the desert;
- Using proper planting, fertilization, and maintenance techniques;
- Grading sites to direct rainfall into planted areas;
- Avoiding the use of water-intensive plants within rights-of-way thus emphasizing the community's commitment to low water use designs.

6.10.4 New Large Landscape User Program

The new large landscape user program for the Third Management Plan is similar to that in the Second Management Plan. In addition to the requirements that apply to all industrial users, new large landscape

users must limit the percentage of water-intensive landscaped area above a specified square footage. The facility must limit its water-intensive landscaped area to the greater of the following: (1) 10,000 square feet (20,000 square feet for hotels and motels) plus 20 percent of the area in excess of 10,000 square feet (20,000 square feet for hotels and motels); and (2) the total surface area of all bodies of water within the facility that qualify as water-intensive landscaped area.

Water-intensive landscaping includes not only high water using plants such as turf, but bodies of water such as ponds. However, it does not include any area of land watered exclusively with direct use effluent or effluent recovered within the area of impact, bodies of water used primarily for swimming, bodies of water filled and refilled exclusively with such effluent, and bodies of water allowed under an interim water use permit pursuant to the Lakes Bill if the body of water will be filled and refilled exclusively with such effluent after the permit expires. If 100 percent wastewater is used to water the landscape, the requirements do not apply. For example, if there were sufficient cooling tower blowdown water and greywater available from the operations of a hotel, this wastewater could be used to water any amount of water-intensive landscaped area up to 10 acres. Once a water-intensive landscaped area exceeds 10 acres in size it is defined as a turf-related facility and is subject to regulation under that program.

6.10.5 Industrial Conservation Requirements and Monitoring and Reporting Requirements for New Large Landscape Users

6-1001. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-201 of this chapter, unless the context otherwise requires, the following words and phrases used in sections 6-1002 and 6-1003 of this chapter shall have the following meanings:

1. *"Direct use effluent" means effluent transported directly from a facility regulated pursuant to Title 49, Chapter 2, Arizona Revised Statutes, to an end user. Direct use effluent does not include effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes.*

2. *"Effluent recovered within the area of impact" means effluent that has been stored pursuant to Title 45, Chapter 3.1, Arizona Revised Statutes, and recovered within the stored effluent's area of impact. For purposes of this definition, "area of impact" has the same meaning as prescribed by A.R.S. § 45-802.01.*

3. *"Landscapable area" means the entire area of a lot less any areas covered by structures, parking lots, roads, or any other area not physically capable of being landscaped.*

4. *"New large landscape user" means a non-residential facility that has a water-intensive landscaped area in excess of 10,000 square feet and that has landscaping planted and maintained after January 1, 1990 or bodies of water, other than bodies of water used primarily for swimming purposes, filled and maintained after January 1, 1990, or both. Turf-related facilities as defined in section 6-301 of this chapter are excluded from this definition.*

5. *"Water-intensive landscaped area" means, for the calendar year in question, all of the following areas within a non-residential facility:*

   A. *Any area of land that is planted primarily with plants not listed in Appendix 5I, Drought Tolerant/Low Water Use Plant List, or any modifications to the list, and watered within a permanent water application system, except any area of land that is watered exclusively with direct use effluent or effluent recovered within the area of impact.*

   B. *The total water surface area of all bodies of water within the facility, except bodies of water used primarily for swimming purposes, bodies of water filled and refilled exclusively with direct use effluent or effluent recovered within the area of impact, and bodies of water allowed under an interim water use permit pursuant to A.R.S. § 45-133 if the bodies of water will be filled and refilled exclusively with direct use effluent or effluent recovered within the area of impact after the permit expires.*

6-1002. Conservation Requirements

A. Conservation Requirements for New Large Landscape Users that are not Hotels or Motels

Beginning on January 1, 2002 and continuing thereafter until the first compliance date for any substitute conservation requirement in The Fourth Management Plan, the water-

intensive landscaped area within a new large landscape user that is not a hotel or motel shall not exceed the greater of the following: (1) an area calculated by adding 10,000 square feet plus 20 percent of the facility's landscapable area in excess of 10,000 square feet; and (2) the total water surface area of all bodies of water within the facility that are allowed under A.R.S. § 45-131 et seq., and that qualify as water-intensive landscaped area.

B. Conservation Requirements for New Large Landscape Users that are Hotels or Motels

Beginning on January 1, 2002 and continuing thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management Plan, the water-intensive landscaped area within a new large landscape user that is a hotel or motel shall not exceed the greater of the following: (1) an area calculated by adding 20,000 square feet plus 20 percent of the facility's landscapable area in excess of 20,000 square feet; and (2) the total water surface area of all bodies of water within the facility that are allowed under A.R.S. § 45-131 et seq, and that qualify as water-intensive landscaped area.

C. Waiver of Conservation Requirements for the Use of 100 Percent Wastewater

The conservation requirements set forth in subsections A and B of this section shall not apply to a new large landscape user in any year in which all of the water used for landscaping purposes within the facility is wastewater.

6-1003. Monitoring and Reporting Requirements

For calendar year 2002 or the calendar year in which the facility first begins to use water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirement in the Fourth Management Plan, an industrial user that applies water to a new large landscape user shall include the following information in its annual report required by A.R.S. § 45-632:

1. *The total quantity of water from any source, including effluent, withdrawn, diverted, or received for use on the facility during the calendar year for landscape watering purposes, including bodies of water filled or refilled during the calendar year, as measured with a measuring device in accordance with the Department's measuring device rules. A.A.C. R12-15-901, et seq.*

2. *The total amount of landscapable area within the facility.*

3. *The total amount of water-intensive landscaped area at the facility broken down into the area planted primarily with plants not on the Drought Tolerant/Low Water Use Plant List, or any modifications to the list (except any area watered exclusively with direct use effluent or effluent recovered within the area of impact) and the surface area of all bodies of water (except bodies of water used primarily for swimming purposes, bodies of water filled and refilled exclusively with direct use effluent or effluent recovered within the area of impact, and bodies of water allowed under an interim water use permit if the bodies of water will be exclusively with direct use effluent or effluent recovered within the area of impact after the permit expires).*

6.11 NEW LARGE INDUSTRIAL USERS

6.11.1 Introduction

New large industrial users are those industrial users that use in excess of 100 acre-feet of water per year and commenced use after January 1, 1990. As of December 1997, one new large industrial user had been identified during the second management period in the Pinal AMA. In this category, are those users that do not fit the specific industrial facility definitions in this chapter (e.g., metal mines, turf-related facilities, etc.). Therefore, while several new industrial facilities, such as sand and gravel and turf-related facilities, have commenced operation in the AMA since January 1, 1990 and use more than 100 acre-feet per year, these industrial users are subject to specific conservation requirements previously discussed in this chapter.

6.11.2 Water Use by New Large Industrial Users

The one new large industrial user identified in the Pinal AMA during the second management period, United-Concept's correctional facility near Eloy, used nearly 187 acre-feet of groundwater in 1995. There are 11 water rights and permits categorized under the "other industrial" subsection that have allotments of over 100 acre-feet per year but are currently using less than that or are not using any water at all. The annual allotments for these 11 facilities total nearly 7,800 acre-feet.

6.11.3 Program Development and Issues

There were no requirements for new industrial users in the First Management Plan. In addition to the conservation requirements for all industrial users, the Second Management Plan contains a specific conservation requirement for new industrial users that use more than 100 acre-feet per year to prepare and submit a water conservation plan that addresses the water conservation opportunities at the facility. Additionally, facilities that expand and increase their water use to greater than 100 acre-feet per year are required to do the same.

The Department has determined that submitting a conservation plan is a reasonable requirement to continue for the third management period considering the large volume of unused allotments that could be used for new large industrial uses and the corresponding opportunity to design water conservation into new or expanding facilities.

6.11.4 New Large Industrial User Program

The new large industrial user program for the Third Management Plan is identical to that of the Second Management Plan. In addition to the requirements under section 6.2.6 that apply to all industrial users, new large industrial users must prepare and submit a water conservation plan to the director. However, if the facility is required to submit a conservation plan under another section of this chapter, then they can combine these and submit one plan.

The water conservation plan must show how much water conservation can be achieved at the facility. It must identify how water is used at the facility and what can be done to conserve it in major water use areas. The plan must also describe an employee water conservation education program at the facility and when conservation measures will be implemented.

6.11.5 Industrial Conservation Requirements and Monitoring and Reporting Requirements for New Large Industrial Users

6-1101. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes and section 6-201 of this chapter, "new large industrial user" means an industrial user that begins using more than 100 acre-feet of water per year for industrial purposes after January 1, 2000.

6-1102. Conservation Requirements

A. *Not later than January 1, 2002 or within 180 days after the end of the first calendar year in which the facility first uses more than 100 acre-feet of water for industrial purposes, whichever is later, a new large industrial user shall submit to the director a plan to improve the efficiency of water use by the facility. The plan shall:*

1. *Specify the level of water conservation that can be achieved assuming the use of the latest commercially available technology consistent with reasonable economic return;*

2. *Identify water uses and conservation opportunities within the facility, addressing water used for the following categories as appropriate: landscaping; space cooling; process-related water use, including recycling; and sanitary and kitchen uses;*

3. *Describe an ongoing water conservation education program for employees; and*

4. *Include an implementation schedule.*

B. *If a person required to submit a plan under subsection A of this section is required to submit a conservation plan under another section of this chapter, the person may combine the plans into a single conservation plan.*

REFERENCES

Brown, P., Gilbert, J., and D. Kopec, 1996. *Final Report to the Arizona Department of Water Resources, Turfgrass Irrigation Scheduling Using Weather Based Estimates of Evapotranspiration for High and Low Traffic Turfs*. Contract No. CA94TU103-00, May 31, 1996.

APPENDIX 6A
EXISTING TURF-RELATED FACILITIES
PINAL ACTIVE MANAGEMENT AREA

Category	Facility
Schools	Casa Grande Junior High School Casa Grande Union High School Cholla Elementary School Coolidge Central and High School Coolidge West Elementary School Cottonwood Elementary School Eloy Junior High School Evergreen Elementary School Florence Elementary and Middle School Florence Unified School District Maricopa Unified Schools Santa Cruz Valley Union High School
Golf Courses	Arizona City Club Dave White Regional Park[1] Desert Fairways Golf Club Eloy-Tohono Golf Course[1] Francisco Grande Resort and Golf Club Hohokam Country Club Three Parks Fairways Vista Verde Executive Golf Course[2]
Common Areas	Casa Grande Lakes

[1] Non-Regulated User
[2] Currently using 100 percent CAP water

APPENDIX 6B
DAIRY OPERATION BEST MANAGEMENT PRACTICES PROGRAM
STANDARD BEST MANAGEMENT PRACTICES

WATER USE CATEGORY 1. DELIVERY OF DRINKING WATER FOR DAIRY ANIMALS	
Description: The level of milk production, season of year and type of dairy animal housing has a significant effect on the water intake of a dairy animal. The drinking water needs of a lactating cow will vary from 25 to 45 gallons per day. As milk production per cow per day increases, drinking water intake will also increase. Conservation of dairy animal drinking water could best be accomplished by preventing and promptly repairing leaks in the drinking water system.	
BMP 1.1	Install and maintain valves and floats throughout the drinking water system to allow for the isolation of leaks in lines and tanks. The Annual Report required by A.R.S. § 45-632 shall include a water system map of the dairy facility showing the location of all valves and floats. This map shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the location of the valves or floats.
BMP 1.2	Inspect the drinking water system for leaks daily to ensure that leaks are promptly identified and repaired to prevent water loss. If a leak occurs, stop water flow by isolating the area of the leak and/or repair the leak within 72 hours.
WATER USE CATEGORY 2. UDDER WASHING AND MILKING PARLOR CLEANING	
Description: Udder washing and milking parlor cleaning is the single largest water use at a dairy operation. Floor and wall wash and sanitation of the milking area is necessary for producing a safe product. These systems can be either manual or semi-automatic. The amount of water used also depends on weather conditions. Udder washing and milking parlor cleaning offer the greatest conservation potential at a dairy through management of the system.	
2.1 UDDER WASH SYSTEM	
BMP 2.1.1	Install and operate the udder washing system with automatic timers. When udder washing, use a maximum of one minute of water for the soak cycle followed by a minimum of two minutes off and a maximum of three minutes of water for the wash cycle followed by one minute off. Repeat with a second wash cycle if needed.
BMP 2.1.2	Install a grid no larger than six feet by five feet between sprinkler heads on wash pens installed or renovated after January 1, 2002. The Annual Report required by A.R.S. § 45-632 shall include a water system map of the dairy facility showing the location of all sprinkler heads and the dimensions of the wash pens. This map shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the location of the sprinkler heads or to the dimensions of the wash pens.

BMP 2.1.3	Install lock-out devices so that the wash system can be used only once per group of cows unless exceptional conditions require an override of the lock-out device. The Annual Report required by A.R.S. § 45-632 shall include a water system map of the dairy facility showing the location of all lock-out devices. This map shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the location of the lock-out devices.
BMP 2.1.4	Establish and implement an inspection schedule to properly maintain and replace spray heads and timing devices. Inspect all spray heads and timing devices daily to ensure that they are operating correctly. If a device is found to be malfunctioning, repair or replace the device within 72 hours.
2.2	**MILKING PARLOR FLOOR AND WALL WASHING**
BMP 2.2.1	Equip all parlor hoses with shut-off valves. Inspect all hoses and valves daily. If a leak occurs, stop water flow by isolating the area of the leak and/or repair the leak within 72 hours.
BMP 2.2.2	If a semi-automatic floor flush system is used, it must be equipped with a timing device to limit the duration of cleaning and be designed to use no more water than necessary unless the water used is water recycled within the dairy operation. The Annual Report required by A.R.S. § 45-632 shall include a description of the flush system that includes the flush schedule and the amount of water used for each flush. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the timing device.
WATER USE CATEGORY 3. CORRAL DESIGN AND MAINTENANCE **Description:** Proper corral design and maintenance will reduce water use in the cow wash pen prior to milking by reducing the amount of wash time necessary to clean the cow. Sloping and maintaining the corral in a dry condition keeps the cow in a cleaner condition.	
BMP 3.1	Slope corrals to prevent standing water and to promote drainage to the wastewater system. The Annual Report required by A.R.S. § 45-632 shall include a dairy facility map that shows the corral design and the direction of slope. This map shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to corral design.
BMP 3.2	Scrape, harrow or drag corrals to eliminate holes and maintain corrals in a dry condition. The Annual Report required by A.R.S. § 45-632 shall include a description of corral maintenance for wet and dry conditions and a maintenance schedule. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in corral maintenance.

APPENDIX 6B
DAIRY OPERATION BEST MANAGEMENT PRACTICES PROGRAM
STANDARD BEST MANAGEMENT PRACTICES

WATER USE CATEGORY 4. CLEANING AND SANITIZING MILKING EQUIPMENT

Description: Cleaning and sanitizing milking equipment is necessary to provide a safe dairy product. Water is also used in pre-coolers and vacuum pumps during the milking operation. Water used for this purpose is usually between 5-10 percent of the total water use at the dairy operation. This water can be recycled for other uses at the dairy.

4.1 MILK COOLING AND VACUUM PUMP

BMP 4.1.1 If the milk cooling and vacuum pump system is water-cooled and is not a closed system, reuse water from the system to wash cow udders or pens, or for any other uses, consistent with state and federal sanitary codes.

The Annual Report required by A.R.S. § 45-632 shall include a description and diagram of how water is reused from the milk cooling and vacuum pump system. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in how water is reused from the milk cooling and vacuum pump system.

4.2 MILK LINE WASHING

BMP 4.2.1 Install and operate the milk line washing system with an automatic or semi-automatic timing device.

The Annual Report required by A.R.S. § 45-632 shall include a description of how the milk line washing system operates. The description shall include the number of cycles per washing and the amount of water used per washing. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the number of cycles per washing and the amount of water used per washing.

4.3 BACK-FLUSH SYSTEMS

BMP 4.3.1 Maintain and service all back-flush systems in accordance with the manufacturer's design specifications and maintenance schedule.

The Annual Report required by A.R.S. § 45-632 shall include the manufacturer's design specifications and a maintenance schedule. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the back flush system.

APPENDIX 6B
DAIRY OPERATION BEST MANAGEMENT PRACTICES PROGRAM
STANDARD BEST MANAGEMENT PRACTICES

WATER USE CATEGORY 5. DUST CONTROL, CALF HOUSING CLEANING AND FEED APRON FLUSHING **Description:** Control of dust, wastes and feed residues is necessary for fly control, sanitation and animal health. This requires water for cleaning and flushing feed aprons and calf housing and for wetting roadways. Conservation potential in this category includes recycling and reusing water, avoiding waste, and employing simple technologies that can reduce the amount of water needed for dust control.	
BMP 5.1	If the dairy flushes the cow feed apron, design the systems to recycle water from the cow udder wash system or to pump wastewater and recycle it from the lagoon or wetland area. The Annual Report required by A.R.S. § 45-632 shall include a description of how water is recycled at the operation, an estimate of the amount of water recycled, and the method of estimation. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to how water is recycled.
BMP 5.2	If the calf housing utilizes a flush system to remove animal wastes, design and manage the system so that it uses only the minimum amount necessary and equip with a timer to minimize the duration of each flush. The Annual Report required by A.R.S. § 45-632 shall include a description of how the system is designed and managed to minimize water use, the length of time of each flush and the number of times per day on average that the system is in operation, and a water system map of the facility showing the location of the timer. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the design or operation of the flush system.
BMP 5.3	If dust control practices are used at the facility, the following dust control methods should be used: paving, aggregate, chemical binding agents or dairy wastewater if consistent with state and federal standards. If potable water is used for dust control it must be used as efficiently as possible. The Annual Report required by A.R.S. § 45-632 shall include a description of the dust control technology(ies) used and the area on which dust control is practiced, and the amount of water used for dust control. If water use is estimated, provide a description of how water use is estimated. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to dust control practices.

APPENDIX 6B
DAIRY OPERATION BEST MANAGEMENT PRACTICES PROGRAM
STANDARD BEST MANAGEMENT PRACTICES

WATER USE CATEGORY 6. DAIRY ANIMAL COOLING	
Description: Dairy animal cooling is an effective method to improve milk production per cow and reproductive efficiency, which are important factors in dairy profitability. Animal cooling is also an important factor in improving animal health. The amount of water required depends on the type of method or methods used to cool cows, on the maintenance practices for the system and on the hours of usage. Methods to conserve water for each cooling system are available to dairy farm management.	
6.1	**HOLDING PEN COOLING**
BMP 6.1.1	Design and operate independent fan and spray systems to ensure that water is used efficiently under all weather conditions. The Annual Report required by A.R.S. § 45-632 shall include a diagram demonstrating that fans and spray systems are used independently and provide information on how the system is managed depending on weather conditions. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change to the fan and spray systems.
6.2	**COW EXIT AND RETURN LANES COOLING**
BMP 6.2.1	Use leaf gate, wand switch, electric eye or motion (proximity) indicators to automatically activate the water valve. The Annual Report required by A.R.S. § 45-632 shall include a description of the activation device used at the dairy operation and how it operates, including the length of time the water valve is in operation and the amount of water used, and include the average number of times per day that the device is activated in a year. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in activation device.
6.3	**FEED LINE COOLING**
BMP 6.3.1	Locate the feed line cooling system to take advantage of prevailing winds in order to place water directly on the dairy animal. Equip the system with timers to control the duration of use. The Annual Report required by A.R.S. § 45-632 shall include a water system map of the dairy facility showing the location of all timers and the direction of prevailing winds. Report the length of time the timer is in operation and the average number of times per day that the system is in operation in a year. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the feed line cooling system or timers.

6.4. CORRAL SHADE COOLERS	
BMP 6.4.1	Equip corral shade coolers with thermostats or timers to control operation time. The Annual Report required by A.R.S. § 45-632 shall include a water system map of the dairy facility showing the location of all thermostats or timers and report the average daily length of time the coolers are in operation in a year. This information shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the thermostats or timers.
BMP 6.4.2	Establish an inspection schedule to ensure regular maintenance of nozzles and water filter systems. The Annual Report required by A.R.S. § 45-632 shall include an inspection and maintenance schedule. This schedule shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the maintenance schedule.
WATER USE CATEGORY 7. DAIRY ANIMAL FEED PREPARATION **Description:** Water is used in the preparation of dairy animal feed at dairy operations to pre-soak cereal grain for processing, (rolling and flaking). A large use of water in feed preparation is its addition to the total mixed ration (TMR) to improve feed intake. The amount of water needed depends on the dryness of the feed in the ration. The total amount of water added to the feed could equal 20 percent of the ration. The greatest conservation potential for feed preparation rests with leak detection and prevention.	
BMP 7.1	Install shut-off valves at each water source used for feed preparation to allow for the isolation of leaks. If a leak occurs, isolate the area of the leak and/or repair the leak within 72 hours. The Annual Report required by A.R.S. § 45-632 shall include a water system map of the facility showing the location of all valves. This map shall be submitted one time only (the first annual report following acceptance into the BMP Program) unless there is a change in the location of the valves.